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COOPERATIVE FERTILIZER MARKETING AND MANUFACTURING

1949/50—1969/70 • PLANT CAPACITIES IN 1972

FARMER COOPERATIVE SERVICE • U.S. DEPARTMENT OF AGRICULTURE • FCS RESEARCH REPORT No. 24

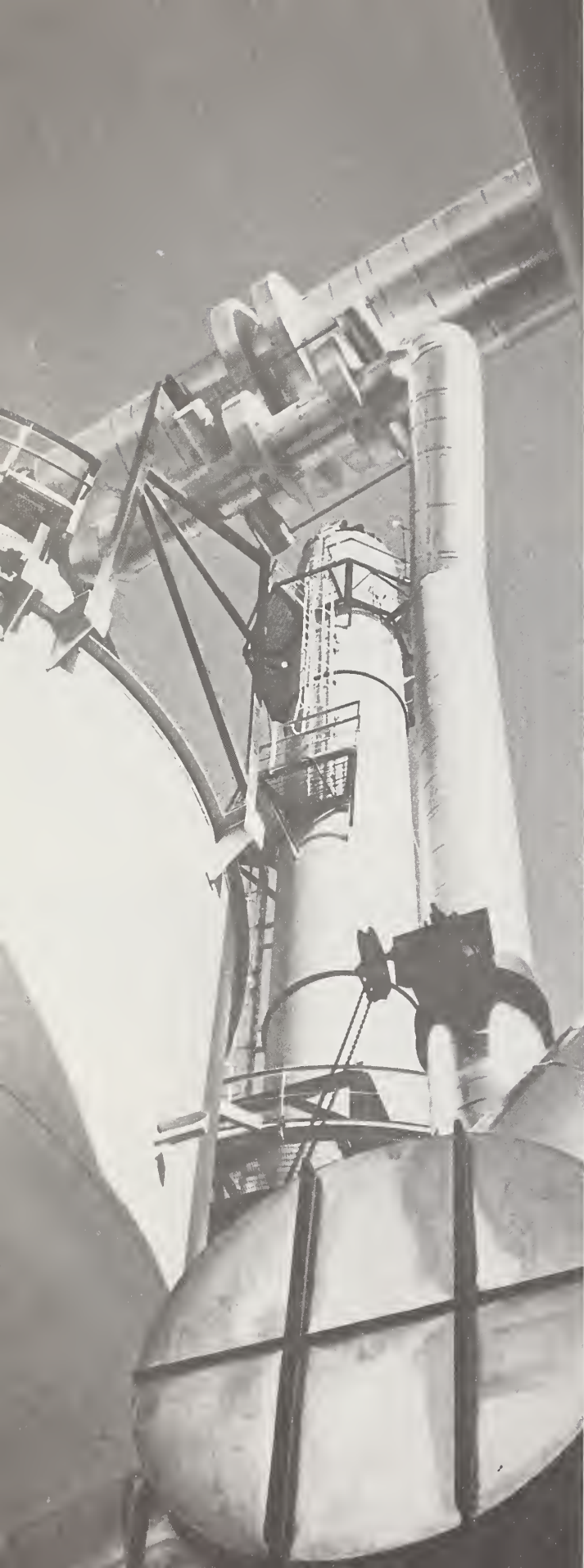


Farmer-owned cooperatives are at the leading edge of cooperative fertilizer manufacturing, both in size of operations and in advanced technology. The cover pattern was made by the mining machine below. The machine cuts through ore at the rate of 10 tons per minute. It is working 3,360 feet below surface in the Canadian potash mine owned jointly by CF Industries, Inc., Chicago, and Noranda Mines, Ltd. Annual production is 1.5 million tons of finished product. CF industries is owned by 18 regional cooperatives in the United States.



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HIGHLIGHTS

Farmers' purchases of fertilizer through their cooperatives increased from \$156 million in 1950/51 to \$657 million in 1969/70. The number of cooperatives handling fertilizers rose from 3,350 to 4,300, and their share of the farm market increased from 15 to 32 percent of the U.S. total during this period.

The quantity and value of fertilizers purchased by all U.S. farmers more than doubled from 1949/50 to 1969/70. Total tons purchased increased from 18.3 million to 39.6 million—an average compound growth rate of 3.9 percent a year. The increase in fertilizer use was greatest in nitrogen and potash materials. Farmers' expenditures for fertilizer rose from \$1,019.5 million to \$2,060 million in the period, yet the cost per ton decreased substantially. Of even greater significance was the increased use of plant nutrients—from 4.1 million tons to 16.1 million tons—an average growth rate of 7.1 percent a year. The average plant nutrient content of fertilizers jumped from 22.7 to 42.9 percent.

Cooperatives sold about 12.5 million tons of fertilizer in 1969/70. Data from 39 cooperatives which acted as suppliers for most local cooperative outlets showed that nitrogen materials comprised 32 percent of their fertilizer volume; phosphate materials, 22 percent; potash materials, 10 percent; and mixtures, 29 percent. Phosphate and potash materials made up a relatively larger proportion and mixtures a much smaller percentage in the cooperatives' volume than they did in the rest of the industry. Cooperatives sold about 41 percent of the straight materials but only 16 percent of the total mixtures sold in 1969/70; however, the reporting of materials, bulk blends, and mixtures may not

Mississippi Chemical Corporation's plant at Pascagoula claims the largest sulfuric acid plant in the world using a technologically new double-contact process. Going on stream in 1972, the plant can manufacture a half-million tons of sulfuric acid annually. It's process is said to be the most efficient and pollution-free system available.

have been entirely comparable between cooperatives and the rest of the industry.

An estimated 95 percent of the fertilizer sales of all cooperatives and franchised agents were to some 1.8 million farmers in 1969/70. Approximately 90 percent of these farmers were cooperative members.

Cooperatives, as user-owned and strongly service-oriented organizations, operate an extensive system of local facilities and custom equipment. In 1969/70, regional associations surveyed and their local cooperatives and dealers operated 1,656 ammonia stations, 1,738 nitrogen solution stations, 2,186 bulk-blending plants, and 2,729 warehouses for bagged products. They also owned several thousand pieces of application equipment for farmers' use.

Cooperatives employed about \$123 million in net fixed assets and \$300 million in working capital in conducting local marketing or distribution of fertilizer in 1970/71.

To supply the local fertilizer distribution system of service facilities and employees, cooperatives manufacture or produce a substantial portion of the basic materials and derivatives they distribute. They have found this advisable to support their distribution or marketing operations logistically and economically; to assure adequate supplies, especially in rush seasons; to help control quality; to obtain additional savings or lower costs; and to help develop new products and services.

Of total U.S. output of basic materials in 1969/70, cooperatives produced 20 percent of the anhydrous ammonia (NH_3) in 14 plants; 27 percent of the wet phosphoric acid (P_2O_5) in seven plants; 19 percent of the normal superphosphate (P_2O_5) in 14 plants; and 3 percent of the U.S. and Canadian potash (K_2O) in one plant. Ten years earlier, their production accounted for only 7 percent of the ammonia, 4 percent of the phosphoric acid, and 21 percent of the normal superphosphate.

Of total U.S. output of derivatives in

1969/70, cooperatives produced 32 percent of the solid ammonium nitrate, 15 percent of the nitrogen solutions and solid urea, 21 percent of the synthetic ammonium sulfate, 24 percent of the triple or concentrated superphosphate, 35 percent of the ammonium phosphates, 17 percent of the chemical dry mixtures, and 16 percent of the liquid mixtures. In 1959/60, the cooperatives' share of U.S. production was as follows: ammonium nitrate, 26 percent; ammonium phosphates, 13 percent; dry mixtures, 16 percent; and all other derivatives, under 6 percent.

In 1969/70, the study cooperatives produced—in their own plants—67 percent of the total plant nutrients they sold. The proportions they produced of major types of nutrients they sold were as follows: nitrogen (N), 87 percent; phosphates (P_2O_5), 73 percent; and potash (K_2O), 16 percent. Cooperatives therefore have not been responsible for overproduction in recent years, even though they have manufactured an increasing percentage of their known market needs.

In 1970, cooperatives had invested \$510 million in fertilizer manufacturing, mixing, and primary storage facilities. These facilities' depreciated value was \$328 million. In addition, \$170 million was in use as operating capital. When these amounts are added to investments in fertilizer marketing, cooperatives were using about \$922 million in all fertilizer operations, or over \$500 per farmer-member purchasing fertilizer through them.

On January 1, 1971, cooperatives had about 7,600 full-time employees in fertilizer production and marketing, of which 4,247 were full-time employees engaged in fertilizer manufacturing, primary distribution, and related administrative and office functions. Some additional 10,800 employees distributed fertilizer, feed, seed, and other supplies at the local level. Thus, approximately 22,650 employees were engaged in fertilizer operations at that time.

Cooperative Farm Chemicals Association, Lawrence, Kan., has been in almost a constant state of expansion since it went on stream in 1954. Built by Farmland Industries, Inc., Kansas City, Mo., it is now owned jointly by Farmland and Missouri Farmers Association, Columbia. Annual production of ammonia, ammonium nitrate, and urea nitrate solutions is in excess of 600,000 tons. Present construction is for a 600-ton-per-day solid urea plant (both animal feed and fertilizer grade), with completion expected in early 1974.



COOPERATIVE FERTILIZER MARKETING AND MANUFACTURING

1949/50 — 1969/70 • PLANT CAPACITIES IN 1972

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Major changes have occurred in recent years in the use of fertilizer on U.S. farms. Use of fertilizer materials has more than doubled, and consumption of plant nutrients has increased more than four times since 1950. The greatest increases have occurred in the Central States. Significant changes also have occurred in the types of fertilizers used and in the ways they are applied to the soil. During the same time, major changes have taken place in the fertilizer industry—including change of ownership, entry of new firms, and development of integrated complexes that produce and market all three primary plant nutrients.

Farmer cooperatives have made significant progress in purchasing and in manufacturing their members' plant food needs in the last 20 years. Cooperatives have contributed to the development of the fertilizer industry through many pioneering efforts—especially those which have benefited farmer users. Examples are: (1) emphasizing high-analysis fertilizer, (2) expanding bulk blending and direct application of materials, and (3) providing various services and agronomic advice on the use and application of plant foods.

PURPOSE AND METHOD OF STUDY

This study describes trends since 1950 and present status of the principal cooperatives in supplying fertilizer to farmers. It shows their share of fertilizer sales; their plant capacity and

share in manufacturing basic fertilizer materials and their derivatives; and some of the reasons why cooperatives have integrated operations back to the production of such plant foods. Also included are estimates of the amount of cooperative investments in fertilizer marketing and production facilities and the number of local employees and service facilities supported by the manufacturing operations of farmer cooperatives.

Data on total fertilizer sales of all cooperatives from 1950/51 through 1969/70 were obtained from annual publications of Farmer Cooperative Service. Data on various products marketed in 1969/70 and on products manufactured in 1960, 1965, and 1970 were obtained by mail questionnaire from 39 principal cooperatives. Data on plant capacity for these years and 1972 also were obtained by mail. Questionnaires requested information for calendar 1969 or the cooperative's business year ending in 1970.

Fourteen of these cooperatives and their subsidiaries were regional or national in scope and produced one or more basic materials and various derivatives of these materials (app. tables 1 and 2). Twelve of this group plus 10 other cooperatives, or a total of 22, produced chemical mixtures. Of the remaining 15 associations, 10 wholesaled and, in some cases, bulk-blended fertilizers; and five bulk-blended only, although they had operated mixing plants in earlier years.

Information on total consumption of

fertilizer, plant capacity, and production for all firms in the United States from 1950/51 through 1969/70 was obtained from various reports issued by the U.S. Department of Agriculture, U.S. Bureau of Mines, U.S. Bureau of the Census, and U.S. Tariff Commission.

FERTILIZER USE, 1949/50 TO 1969/70

Total volume of fertilizer products sold increased from 18.3 million tons in 1949/50 to 39.6 million tons in 1969/70 (table 1 and app. table 6)—an average compound growth rate of 3.9 percent a year.

The greatest increase in fertilizer sales or use occurred in straight materials containing nitrogen (N) and potash (K) (table 1). The growth rate for nitrogen averaged 9.9 percent per year from 1949/50 to 1969/70, while that for potash was 14.2 percent—in contrast to the growth rate of 2.7 percent for mixed fertilizers.

Phosphate (P) use, however, declined from 3.4 million tons in 1949/50 to 2.5 million tons in 1969/70—owing largely to a reduction in the use of direct-application phosphate rock and low-analysis converted phosphates. As indicated later, however, the phosphate nutrient content of fertilizers actually increased during the period.

The use of N-P-K mixtures increased from 12.3 million tons in 1949/50 to about 21 million

tons in 1969/70—an average growth rate of 2.7 percent a year.

Of greater significance than the increased consumption of fertilizer products has been the growth in use of plant nutrients as a result of the increase in the quantity of fertilizer applied and the amount of nutrient in the fertilizer (table 2). The analysis of total plant nutrients for all fertilizers increased from 22.7 percent in 1949/50 to 42.9 percent in 1969/70—an average compound growth rate of 3.3 percent. Nitrogen increased most—from 5.6 percent to 19.5 percent—a growth rate of 6.4 percent a year.

Use of total primary plant nutrients increased from 4.1 million tons in 1949/50 to 16.1 million in 1969/70—an average growth rate of 7.1 percent a year (table 2). Use of N increased from 1 million to about 7.5 million tons—a 10.5-percent annual increase. Use of P_2O_5 increased from 1.9 million to 4.6 million tons, or 4.3 percent a year—contrasted with a decline in product tonnage of 1.4 percent annually (table 2). Use of K_2O increased from 1.1 million to 4 million tons—an average growth rate of 6.7 percent a year.

The 7.1-percent annual increase during 1949/50 to 1969/70 in the use of plant nutrients, compared with the 3.8-percent annual increase in farmers' fertilizer expenditures, has meant a substantial decrease in average cost per ton of

Table 1—Use of fertilizer products in the United States and Puerto Rico, by major type, 1949/50, 1959/60, and 1969/70

Product	1949/50	1959/60	1969/70	Compound growth rate, 1950-70
	1,000 tons			Percent
Straight materials:				
Nitrogen	1,786	4,545	11,898	9.9
Phosphate	3,358	2,339	2,522	-1.4
Potash	169	474	2,410	14.2
Subtotal or average	5,313	7,358	16,830	5.9
N-P-K mixtures	12,298	15,650	20,963	2.7
Other ¹	732	1,869	1,798	4.6
Total or average	18,343	24,877	39,591	3.9

¹ Natural organic materials and micronutrient materials.

Table 2—Fertilizer nutrient consumption in United States and Puerto Rico, by major types, 1949/50, 1959/60, and 1969/70

Plant nutrient	1949/50	1959/60	1969/70	Compound growth rate, 1950-70
	----- 1,000 tons -----			Percent
Quantity used of:				
Nitrogen (N)	1,005	2,738	7,459	10.5
Phosphoric oxide (P ₂ O ₅)	1,950	2,573	4,574	4.3
Potassium oxide (K ₂ O)	<u>1,103</u>	<u>2,153</u>	<u>4,036</u>	<u>6.7</u>
Total	4,058	7,464	16,069	7.1
	----- Percent -----			
Average analysis (proportion of nutrient in the fertilizer):				
Nitrogen (N)	5.6	11.7	19.5	6.4
Phosphoric oxide (P ₂ O ₅)	10.9	10.9	12.9	0.8
Potassium oxide (K ₂ O)	<u>6.2</u>	<u>9.2</u>	<u>10.5</u>	<u>2.7</u>
Total or average	22.7	31.8	42.9	3.3

plant nutrients to farmers in the last two decades. Farmers' expenditures for fertilizer increased from about \$1,020 million in 1950/51 to \$1,303 million in 1959/60 and to \$2,153 million in 1969/70—representing a compound growth rate of 3.8 percent a year, on the basis of constant prices.

TRENDS IN THE FERTILIZER INDUSTRY

Few industries have experienced such a complete change in structure and ownership and such drastic variations in prices and profits in recent years as the fertilizer industry.

Early in the 1960's, major oil companies began to enter the fertilizer field by acquiring old-line fertilizer manufacturing companies or large synthetic anhydrous ammonia plants and by establishing distribution outlets commonly called farm service centers. Their entry was prompted by potentially high margins in converting captive natural gas to nitrogen fertilizers, marked increase in nitrogen use in the Midwest and central part of the country, and prospects for export sales under foreign aid programs. Potential sales of petroleum products to farmers also was a factor.

In the 1950's and early 1960's, various conglomerates in industry had consisted of three

major types of producers—nitrogen, phosphate, and potash. Most were separate companies specializing in one type of product. These companies began to diversify into two or three products, and they began integrating manufacturing operations forward with expanded distribution and farm marketing systems.

Many early nitrogen plants had capacities of 500 tons a day. Technological improvements later favored the building of larger plants with capacities of 1,000 tons a day or more. Also, new phosphate plants had larger capacities for the same reason.

These developments eventually resulted in overexpansion in nitrogen and phosphate manufacturing plants. In 1964, the nitrogen sector of the industry was operating at 95 percent of capacity. By 1966, there were 18 new ammonia plants, including 10 large ones with average daily capacities of 800 tons per year, and all plants were operating at 80 percent of capacity. Another 25 plants have been built since then, but 33 smaller ones had been closed by the end of 1971.

The industry operating rate for phosphates was 87 percent of capacity in 1965. By 1967, additional wet process phosphoric acid plant capacity had reduced the operating rate to 71 percent.

In 1964, the North American demand for potash was 84 percent of production capacity. Increases in plant capacity, especially in connection with the development of the Saskatchewan potash deposits, reduced the operating rate to 50 percent by 1970.

Most of the increased plant capacities for these plant nutrients resulted in overproduction, and upset the industry's supply-demand balance. Furthermore, foreign markets did not materialize as expected and competition for the domestic farm market became intense. Prices were reduced and services to farmers increased. For example, anhydrous ammonia, which had been selling at \$88 to \$92 a ton, f.o.b., at many Southern and Midwestern plants, declined to \$40 a ton, delivered, in some areas in 1968 and 1969. The average price paid by farmers for 18-46-0 was \$94 a ton in 1970—down from \$120 a ton in 1962. As a result, most plants reported operating at a loss, and the rest showed little profit. Some companies curtailed or discontinued retail distribution and closed small, obsolete plants.

By mid-1971, some degree of order had begun returning to the industry and prices began inching upward. The industry operating rate for nitrogen was 88 percent of capacity, and the P_2O_5 rate was 83 percent. But the potash operating rate, although improving slightly, was still only 51 percent in North America and 79 percent worldwide. Plant capacity and distribution systems for nitrogen and phosphate and demands for these fertilizers thus were beginning to come into balance. Potash prices, however, continued to be controlled by the Saskatchewan Provincial Government. Earnings from fertilizer operations have improved, especially for plants that operated at capacity, and for many retail distributors.

As described in the following sections, farmer cooperatives have become an increasingly important segment of the fertilizer industry—both in marketing and in producing plant food. They have long been mixers and marketers of fertilizer, and in recent years they have begun manufacturing basic materials. But they were not responsible for the recent overcapacity in basic production plants, because they built or acquired plants only to help supply a known demand or

farm market. Their present production is considerably less than the requirements of their local distribution or marketing systems.

COOPERATIVE FERTILIZER MARKETING

Farmer cooperatives have long marketed fertilizers. They began by distributing directly from railcars before World War I. Their fertilizer dollar volume has grown until it now ranks third in cooperative supply sales. About 4,300 cooperatives, with several hundred additional branch outlets, now handle plant food.

Because cooperatives are user owned and service oriented, they have worked closely with land-grant universities in determining the best types of fertilizer to distribute to farmers. Most have promoted the use of high-analysis fertilizers as best buys for farmers, rather than handle products that might have made greater net margins for the cooperative.

Sales and Share of Market, 1950/51 to 1969/70

Cooperatives' net sales of fertilizer increased from \$156 million in 1950/51 (the first year for which complete data were available) to \$657 million in 1969/70—an average compound growth rate of 3.6 percent a year (table 3). Their share of the farm market increased from 15 percent to about 32 percent during this period—0.9 percent a year. Cooperatives' largest share of the market is in the Midwestern, Midsouthern, and Northeastern Regions of the United States. The number of cooperatives handling fertilizer increased from 3,352 in 1950/51 to 4,409 in 1964/65, but was down to 4,294 in 1969/70.

Data were not available on tonnages of products all cooperatives sold during this period.

Some reasons for cooperatives' progress in providing fertilizer to members were:

1. As user-owned enterprises, cooperative benefits have flowed directly to member-patrons.

2. Cooperatives encouraged the use of high-analysis fertilizers, furnished custom bulk spreading to save time and labor for farmers, provided bulk blending of materials based on soil tests for individual fields, provided other services such as agronomic advice and recordkeeping, and

Table 3—Total U.S. farm expenditures for fertilizer and lime and cooperative share of the market, selected years, 1950/51 - 1969/70

Year (July 1-June 30)	U.S. farm expenditures for fertilizer and lime ¹	Fertilizer sales by cooperatives		
		Amount	Percent of total fertilizer expenditures	Cooperatives handling fertilizer
	----- 1,000 dollars -----		Percent	Number
1950/51 ²	1,019.5	156.1	15.3	3,352
1954/55	1,197.0	250.0	20.9	3,816
1959/60	1,303.0	334.4	25.7	4,338
1964/65	1,727.5	507.1	29.4	4,409
1969/70 ¹	2,153.0	657.1	30.5	4,294
			----- Percent -----	
Compound growth rate, 1951-70	3.8	7.5	--	1.2

-- = not applicable.

¹ Source: Farm Income State Estimates, 1959-1971. FIS 220 Supplement, Aug. 1972. U.S. Dept. Agr., Econ. Res. Serv.

² 1st year for which cooperative sales data were available.

supplied fertilizer through farm service centers so as to share handling costs with other production supplies and farm products marketed.

3. Cooperatives, individually and working together, gradually integrated operations through dry-mixing and ammoniating services; initiated joint purchasing; acquired storage and transportation facilities; and entered the manufacture of basic materials to assure needed seasonal supplies and to provide additional savings for farmer-members.

4. Other important factors were the emergence of more competent management, the help of specialized cooperative credit agencies, and the development of larger, stronger cooperatives at both the local and regional level.

Principal Types of Fertilizer Sold in 1969/70

Data were obtained on the quantities of fertilizer products marketed by 39 cooperatives to indicate the volume which their manufacturing operations support. The composite tonnage consists of some sales at the manufacturing level, some at the wholesaling level, and some at the retailing level.

The cooperatives surveyed were asked to include bulk blends under appropriate materials or products unless their records indicated them as mixtures. Gross and net sales are shown in table 4.

Total Sales

The 39 cooperatives in the study had gross sales of about 15.5 million tons of fertilizers in 1969/70/(table 4). After eliminating intercooperative business, net sales amounted to 10.7 million tons. Straight or direct-application materials totaled about 7.6 million tons, or 71 percent, and mixtures accounted for 3.1 million tons, or 29 percent of total net sales.

The cooperatives reported exporting 455,000 tons of fertilizer in 1969/70. The remaining net sales of 10.2 million tons constituted about 26 percent of all fertilizer products (39,228,000 tons) used in the United States that year. This net volume probably was over 80 percent of total cooperative sales in 1969/70.¹

The cooperatives in this study sold 7.6 million tons of materials, exclusive of secondary, micronutrient, and organic materials—41 percent of the total straight material used in the country. They sold 3.1 million tons of mixtures and blends, or 16 percent of all such products used. However, the percentage or share for

¹Data received annually by Farmer Cooperative Service show that about 32 percent of farmers' expenditures for fertilizer was made through cooperatives in 1969/70. This would indicate total cooperative sales of 12.5 million tons, but this is probably high because cooperatives handled relatively more high-analysis or high-valued fertilizer than other firms.

Table 4 — Sales of fertilizers by 39 cooperatives, 1969/70¹

Product	Average analysis	Gross sales ²	Net sales ²
	Percent N-P-K	1,000 tons	1,000 tons
Nitrogen:			
Anhydrous ammonia	82-0-0	1,883.7	1,348.6
Nitrogen solutions:			
32% N & under	30-0-0	739.8	459.9
Over 32% N	37-0-0	239.2	117.4
Aqua ammonia	20-0-0	130.2	123.7
Ammonium nitrate	33.5-0-0	2,043.3	1,358.8
Ammonium sulfate	21-0-0	313.4	278.8
Solid urea	45-0-0	387.1	337.4
Other	30-0-0	34.5	34.5
Total nitrogen	--	5,771.2	4,059.1
Phosphate:			
Phosphate rock	0-3-0	78.8	42.4
Triple superphosphate	0-46-0	1,102.8	567.1
Normal superphosphate	0-20-0	66.9	66.9
18-46-0	18-46-0	1,654.6	1,114.4
11-48-0	11-48-0	32.4	32.4
16-20-0	16-20-0	80.4	80.4
Phosphoric acid	0-54-0	353.2	293.8
Other ³	12-30-0	365.7	144.9
Total phosphate	--	3,734.8	2,342.3
Potash:			
Muriate of potash	0-0-60	2,620.1	1,137.7
Sulfate of potash	0-0-50	35.8	9.4
Sulf. of potash-magnesia	0-0-22	43.2	17.9
Total potash	--	2,699.1	1,165.0
Mixed fertilizers:			
Dry mixtures ²	NA	2,672.6	2,491.6
Liquid mixtures	NA	89.7	89.7
Bulk blends ²	NA	552.8	552.8
Total mixtures & blends	--	3,315.1	3,134.1
Total fertilizers	--	15,520.3	10,700.5

-- = not applicable. NA = not available.

¹ In cooperatives' business year ending any time between July 1, 1969, and June 30, 1970. The table omits secondary, micronutrient, and organic materials.

² In most cases, regional cooperatives' sales of materials to go into bulk blends were included in material sales rather than in mixed fertilizer or bulk-blend sales.

³ Includes phosphate rock, basic slag, slag-potash, 13-52-0, 10-34-0, monammonium phosphate, and Tennessee Valley Authority materials.

materials is believed to be overstated and the share for mixtures understated, because some materials sold by regional cooperatives to local cooperatives and dealers were resold as bulk blends and liquid mixtures. Also, the materials figures include exports.

Product Sales

Nitrogen materials sales by the 39

cooperatives amounted to 4.1 million tons, or about 39 percent of total 1969/70 cooperative fertilizer sales. Anhydrous ammonia and ammonium nitrate were the principal products sold.

Phosphate sales amounted to 2.3 million tons, or 22 percent of the cooperative total. Diammonium phosphate (18-46-0) was the

principal phosphate type, followed by triple superphosphate.

Potash sales comprised about 1.2 million tons—accounting for 10 percent of the cooperative total.

As mentioned, the remaining 3.1 million tons, or 29 percent of the total, consisted of mixtures—mostly chemically dry-mixed goods.

Patrons Served and Sales to Each Type

The cooperatives surveyed sold fertilizer to a variety of patrons or outlets (fig. 1). National or area cooperatives manufacture, purchase, and sell products to regional wholesale-manufacturing cooperatives; these, in turn, sell fertilizer to local cooperatives and franchised dealers or representatives. Some regional cooperatives sell direct to farmers through branch stores and warehouses that the regionals own.

Ownership of these cooperatives flows in reverse order from the sales pattern (fig. 1). In some areas, farmers own local cooperatives and the locals own regional cooperatives. The latter are called federated cooperatives. In other areas, farmers have direct membership in regional

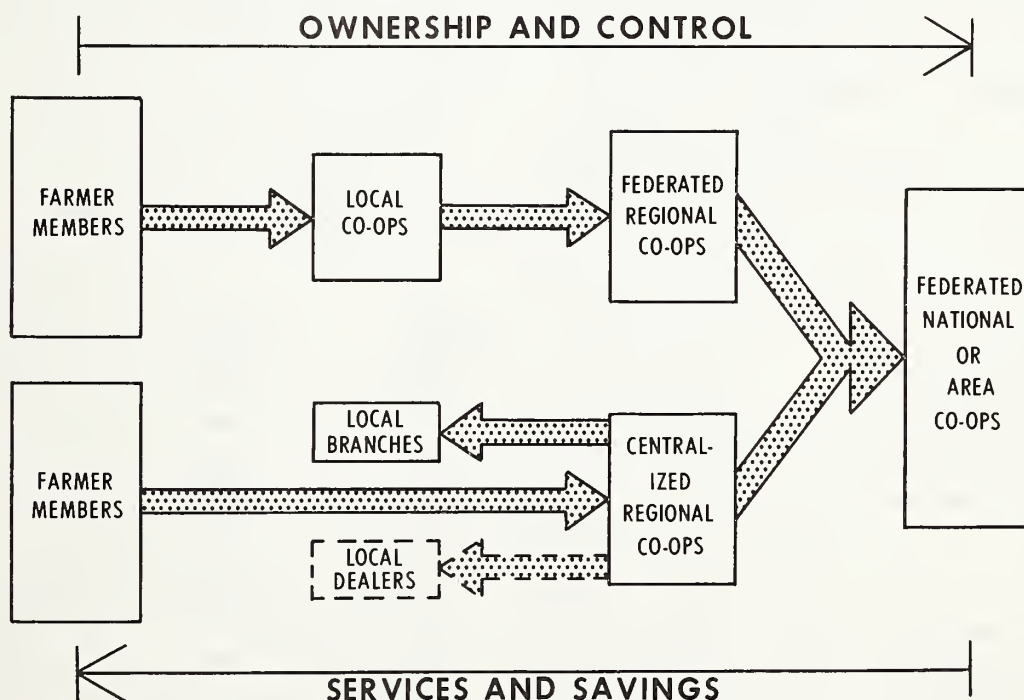
cooperatives called centralized cooperatives. Both types of regionals own the national or specialized area cooperatives.

About 14 percent of the net sales of the cooperatives in this study were made direct to 115,575 farmers, plus some nonfarm individuals (table 5). Sixty-two percent went to 3,873 local cooperatives, 11 percent went to franchised dealers or representatives, and 13 percent went to other firms. Thus, 86 percent of their total volume was sold at wholesale and 14 percent at retail.

All wholesale cooperatives were included in the study. Their total wholesale sales of 9.2 million tons represented 74 percent of the 12.5 million tons (net) sold by all cooperatives at the local or retail level in 1969/70. Almost 45 percent of the net tonnage originated in national or area manufacturing-purchasing cooperatives and then moved on to their member regional cooperatives.

Cooperatives selling direct to farmers estimated that 90 percent of their sales were to farmer-members and 10 percent were to

FIG. 1 COOPERATIVE FERTILIZER SYSTEMS



nonmembers. Regional cooperative officials estimated that 95 percent of the sales of their affiliated local cooperatives and franchised dealers went to farmers and 5 percent to nonfarmers.

Regional cooperatives in this study and their affiliated outlets sold fertilizer to about 2 million farmers in 1969/70. This estimate is made on the assumption that local cooperatives, on the average, sold fertilizer to 475 farmers (60 percent of their average membership) and that franchised dealers served an average of 200 farmers that year.

Local Service Facilities and Equipment Operated

Cooperatives operate a large number of local plants and warehouses and a variety of application equipment to support their manufacturing and mixing plants and to service farmers (table 6). For example, the regional cooperatives in this study and their local affiliated cooperatives and dealers operated 1,656 ammonia stations, 1,738 nitrogen solution stations, 2,203 bulk blending plants, and 2,729 warehouses for bagged products on January 1, 1971.

They also owned and operated (or rented out) over 32,000 nurse tanks, 13,740 liquid application rigs, 9,150 tractor liquid applicator rigs, and over 11,750 dry spreaders (pull-type).

COOPERATIVE FERTILIZER PRODUCTION

Farmers own cooperatives to help them

minimize production costs and maximize crop yields. To achieve this most effectively, cooperatives must integrate their operations as others in the industry have done. This means they must manufacture basic fertilizer materials and derivatives as well as distribute or market them to farmers.

Cooperatives began integrating their fertilizer services from 1920 to 1940 by acquiring dry-mixing plants. By 1950, they operated about 85 plants. Since then, the number of chemical dry-mixing plants has declined, because bulk blending and liquid mixing have become popular. Cooperatives began integrating from marketing or distributing into basic manufacturing in the 1940's with the production of normal superphosphate. They operated 15 to 20 such plants by 1950.

Cooperatives began manufacturing nitrogen and phosphate fertilizers in the 1950's and producing potash at the end of the 1960's.

Cooperatives decided to produce basic fertilizer materials and their derivatives for the following reasons:

1. Cooperatives experienced difficulty in obtaining needed materials to meet their members' highly seasonal fertilizer needs. This was especially true during a shortage of nitrogen fertilizer after World War II. Suppliers naturally first took care of their own demands for products.

2. Cooperatives found their own basic

Table 5 — Type of patron served and volume of fertilizer sold by 39 cooperatives, 1969/70¹

Type of patron	Patrons	Sales	Share of total
	<u>Number</u>	<u>1,000 tons</u>	<u>Percent</u>
Farmers (direct sales)	115,575	1,382.3	12.9
Nonfarmers (direct sales)	NA	111.3	1.0
Local retail cooperatives	3,873	6,629.3	62.0
Regional wholesale cooperatives	23	4,819.8	--
Franchised dealer-agents or representatives	1,332	1,128.6	10.5
Other firms, including importers	NA	1,449.0	13.6
Total gross sales	--	15,520.3	--
Less intercooperative business	--	-4,819.8	--
Total net sales	--	10,700.5	100.0

NA = not available.

-- = not applicable.

¹ For business year ending any time between July 1, 1969, and June 30, 1970.

Table 6—Local fertilizer facilities and kinds of equipment owned by 14 regional cooperatives and their affiliated local cooperatives and franchised dealers, January 1, 1971

Type of plant, warehouse, or equipment	Facilities operated by cooperatives in the study	Facilities operated by affiliated local cooperatives and agents ¹	Total
		Number	
Ammonia stations	205	1,451	1,656
Nitrogen solution stations	366	1,372	1,738
Aqua converters	11	119	130
Liquid mixing plants	32	360	392
Bulk blending plants	239	1,964	2,203
Bulk holding stations	103	451	554
Warehouses for bagged products	347	2,382	2,729
Nurse tanks	1,976	30,206	32,182
Liquid application rigs	599	13,142	13,741
Truck liquid applicator rigs	33	560	593
Tractor liquid applicator rigs	222	8,933	9,155
Dry spreaders (pull-type)	770	10,989	11,759
Dry spreader trucks	² 274	1,859	2,133
Dry tenders (feeder)	420	1,365	1,785
High flotation spreaders	0	27	27

¹ Estimated by the regional cooperatives.

² In addition, these cooperatives employed the services of 303 contract spreader trucks.

production and primary distribution helped to support their marketing operations logistically and economically. Making products available to members when and where needed is of paramount importance.

3. Cooperatives soon discovered that their margins as buyers and sellers were limited and that substantially greater savings could be returned to member local cooperatives and farmer-members by producing basic materials.

4. Cooperatives found that new products could be developed, quality could be controlled, and new methods of application and other services could best be effected by controlling a substantial amount of basic production.

5. In summary, it became apparent that cooperatives could best meet their basic objectives of improving service and quality of product and providing savings in the cost of fertilizer to farmer-members by completely integrating their operations from mines to plants to fields. This new approach reflected the changing of farmers' early methods of applying organic fertilizer (manure from their barnyards)

to modern methods of producing inorganic or chemical fertilizers in facilities off the farm.

Plant Capacity and Production of Basic Materials

The three primary nutrients are produced in basic materials as follows:

Nitrogen (N) is produced mainly as anhydrous ammonia (NH_3).

Phosphoric oxide (P_2O_5) is produced mainly as wet process phosphoric acid. A declining amount is produced as normal superphosphate.

Potassium oxide (K_2O) is produced mainly as muriate of potash.

This section presents data on plant capacity at specified intervals from 1950 to 1972, and on production of basic materials from 1949/50 to 1969/70. Capacities of individual plants are shown in appendix table 1.

Anhydrous Ammonia

On January 1, 1970, five cooperatives and their subsidiaries had 14 anhydrous ammonia plants with a combined design annual capacity of 3,084,000 tons of NH_3 (table 7). This was 18

Table 7—Design annual capacity of industry's and cooperatives' anhydrous ammonia and wet process phosphoric acid plants; their production; and the cooperative share of the market, selected years, 1950-72

Product and year	Capacity on January 1			Production ¹		
	Industry	Cooperative	Cooperative share	Industry	Cooperative	Cooperative share
Anhydrous ammonia (NH ₃):	1950	1,888.6	0	Percent	1,000 tons	Percent
	1960	4,100.0	322.5	0	1,565.6	0
	1965	8,585.0	1,181.0	7.8	4,730.8	312.6
	1970	16,500.0	3,084.0	13.8	8,105.8	955.1
	1972	17,236.0	3,256.0	18.4	13,079.8	2,669.0
				18.7	--	--
Growth rate, 1960-70 ²	15.1	26.0	--	Percent	10.7	24.1
Wet process phosphoric acid (P ₂ O ₅):	1950	NA	0	Percent	1,000 tons	Percent
	1960	1,348.0	104.0	0	NA	0
	1965	2,984.0	225.0	7.7	1,241.7	51.6
	1970	5,945.0	1,328.0	7.5	2,522.4	158.4
	1972	6,379.0	1,330.0	22.3	4,395.2	1,210.8
				20.8	--	--
Growth rate, 1960-70 ²	16.0	29.0	--	Percent	13.5	37.2

-- = not applicable.

NA = not available.

¹ Production of industry is for the calendar year; that for cooperatives is for their business year ending any time between July 1 and next June 30 — for example July 1, 1959, to June 30, 1960.

² Compound growth rate.

percent of total U.S. capacity. Cooperatives had 8 percent of the total in 1960. Recent information indicates 1972 cooperative capacity stood at 3,256,000 tons, or about 19 percent of the U.S. total.

Cooperatives operated no NH_3 plants in 1950. The first cooperative plant to produce NH_3 was built in 1949/50 at Yazoo City, Miss. Cooperatives operated four plants in 1960 and eight plants in 1965.

Cooperatives produced 2,669,000 tons of NH_3 in 1969/70 (table 7). Their share of U.S. production was over 20 percent in 1969/70, compared with 7 percent in 1959/60.

Wet Process Phosphoric Acid

In 1970, four cooperatives had six wet process phosphoric acid plants with a combined annual design capacity of 1,328,000 tons of P_2O_5 (table 7). Most of this capacity—22 percent of the U.S. total in 1970—was acquired recently; cooperatives had less than 8 percent of the total in both 1960 and 1965 and none in 1950. Their share of capacity in 1972 was down slightly from that of 1970.

The first cooperative wet process phosphoric acid plant was acquired in 1954 at Joplin, Mo. Cooperatives operated three plants in 1960 and four plants in 1965.

Output of cooperative plants totaled 1,210,800 tons in 1969/70. Their share of U.S. production was almost 28 percent in 1969/70, compared with 4 percent in 1959/60.

Normal Superphosphate

In 1970, nine cooperatives operated 13 normal and enriched superphosphate plants with a combined annual design capacity of 461,000 tons of P_2O_5 (table 8). This was 31 percent of U.S. capacity. Their capacity totaled around 600,000 tons in 1960 and 1965 in 20 and 18 plants, respectively. Recent reports indicate that cooperatives had reduced their capacity to 166,000 tons on January 1, 1972—a level that was 18 percent of the U.S. total. Industry's capacity to produce normal superphosphate declined 52 percent from 1960 to 1970.

The first cooperative normal superphosphate plant was acquired at Carrolton, Ga., in 1941.

Cooperatives produced only 138,700 tons of P_2O_5 as normal superphosphate in 1969/70, or 19 percent of the U.S. total. Their share of the U.S. total was 21 percent in 1959/60, when they produced 290,700 tons.

Muriate of Potash

Cooperatives had no domestic potash mining or processing facilities in 1970, but one had a joint interest in a Canadian plant which had a yearly capacity of 900,000 tons of K_2O (table 8). This was about 8 percent of the total U.S. and Canadian production capacity. Capacity available to cooperatives was the same in 1972.

Total domestic capacity has increased almost 10 percent since 1960, while all of Canada's capacity, which is now over twice that of the United States, has been established since that time.

A major national cooperative began potash mining and processing in a joint venture with a major Canadian company in 1969. The plant produced 180,000 tons of K_2O for cooperatives in 1969/70, or 3 percent of total North American output.

Plant Capacity and Production of Derivatives and Other Products

Cooperatives own and operate facilities that produce a variety of secondary and tertiary fertilizer products. These facilities convert the basic or primary fertilizer materials—anhydrous ammonia, phosphoric acid or phosphate rock, and muriate of potash—into upgraded forms of fertilizer containing one, two, or all three of the primary nutrients.

Data were obtained on annual design capacities of cooperative plants and on tons of product or materials produced. The latter were converted to a plant nutrient basis for comparisons with total industry production data.

Straight Nitrogen Materials

Ammonium Nitrate (Solid).—On January 1, 1970, six cooperatives operated six plants which had a combined annual capacity of 1,090,000 tons of solid ammonium nitrate

Table 8—Design annual capacity of industry's and cooperatives' normal superphosphate and potash facilities; their production; and the cooperative share of the market, selected years, 1950-72

Product and year	Capacity on January 1			Production ¹		
	Industry	Cooperative	Cooperative share	Industry	Cooperative	Cooperative share
	----- 1,000 tons -----		Percent	----- 1,000 tons -----		Percent
Normal superphosphate (P ₂ O ₅):						
1950	NA	NA	NA	1,684.4	NA	NA
1960	3,100.0	591.0	19.1	1,365.6	290.7	21.3
1965	2,772.0	601.0	21.7	1,138.3	298.2	26.3
1970	1,478.0	461.0	31.2	745.6	138.7	18.6
1972	915.0	166.0	18.1	NA	NA	NA
	-----		Percent	-----		Percent
Growth rate, 1960-70 ²	-7	-2.4	NA	-7.8	-7.1	NA
Potash (U.S. & Canada) (K ₂ O):						
1950	NA	0	0	1,287.7	0	0
1960	2,700.0	0	0	2,510.0	0	0
1965	4,695.0	0	0	4,518.0	0	0
1970	11,200.0	900.0	8.0	6,165.0	180.0	2.9
1972	10,600.0	900.0	8.5	NA	NA	NA
	-----		Percent	-----		Percent
Growth rate, 1960-70 ²	15.2	NA	NA	9.4	NA	NA

NA = not available.

¹ Production of industry is for calendar year; that for cooperatives is for their business year ending any time between July 1 and next June 30.

² Compound growth rate.

Table 9—Design annual capacity of plants for producing nitrogen and phosphate fertilizer derivatives by all firms and by cooperatives on January 1, selected years, 1960-72

Product and year	All firms		Cooperatives		Product and year	All firms		Cooperatives	
	Total	Percent of all firms	Total	Percent of all firms		Total	Percent of all firms	Total	Percent of all firms
Ammonium nitrate—solid (product):	1,000 tons	Percent	1,000 tons	Percent	Ammonium sulfate (product):	1,000 tons	Percent	1,000 tons	Percent
1960	NA	NA	302.5	NA	1960	NA	NA	145.0	NA
1965	2,717.0	27.5	748.0	27.5	1965	NA	NA	290.0	NA
1970	4,028.0	27.1	1,090.0	27.1	1970	3,300.0	8.8	290.0	8.8
1972	3,590.0	36.2	1,300.0	36.2	1972	3,300.0	8.3	274.0	8.3
Growth rate, 1960-70 ¹	--	--	Percent	Percent	Growth rate, 1960-70	--	--	Percent	Percent
			13.7	--			7.2		--
Urea—solid (product):	1,000 tons	Percent	1,000 tons	Percent	Urea—solution (product):	1,000 tons	Percent	1,000 tons	Percent
1960	840.0	1.7	14.0	1.7	1960	NA	26.5	26.5	--
1965	1,413.0	2.1	30.0	2.1	1965	NA	134.6	134.6	--
1970	2,700.0	18.5	498.6	18.5	1970	1,500.0	342.6	342.6	22.8
1972	2,880.0	15.9	456.6	15.9	1972	1,620.0	354.5	354.5	21.9
Growth rate, 1960-70 ¹	13.1	--	Percent	Percent	Growth rate, 1960-70	--	--	Percent	Percent
			43.0	--			30.0		--
Nitrogen solutions (product):	1,000 tons	Percent	1,000 tons	Percent	Nitrogen solutions (product):	1,000 tons	Percent	1,000 tons	Percent
32% & under:					Over 32%				
1960	NA	--	87.0	--	1960	NA	23.0	23.0	--
1965	NA	--	416.0	--	1965	NA	168.0	168.0	--
1970	NA	--	850.0	--	1970	NA	297.7	297.7	--
1972	NA	--	861.0	--	1972	NA	284.7	284.7	--
Growth rate, 1960-70 ¹	--	--	Percent	Percent	Growth rate, 1960-70	--	--	Percent	Percent
			26.0	--			29.0		--

See footnotes at end of table

Continued

Table 9—Design annual capacity of plants for producing nitrogen and phosphate fertilizer derivatives by all firms and by cooperatives on January 1, selected years, 1960-72—Continued

Product and year	All firms	Cooperatives		Product and year	All firms	Cooperatives	
		Total	Percent of all firms			Total	Percent of all firms
	----- 1,000 tons -----		Percent		----- 1,000 tons -----		Percent
Triple or concentrated superphosphate (P ₂ O ₅):				Nitric phosphate (product):			
1960	NA	0	--	1960	NA	0	--
1965	1,700.0	0	--	1965	NA	0	--
1970	1,988.0	409.0	20.6	1970	NA	300.0	--
1972	1,804.0	340.0	18.8				
	----- 1,000 tons -----		Percent				
Ammonium phosphates (product):							
1960	NA	179.0	--				
1965	1,500.0	554.0	36.9				
1970	3,200.0	1,283.5	40.1				
1972	2,800.0	1,444.0	51.6				
	----- 1,000 tons -----	Percent-----					
Growth rate, 1960-70 ¹	--	23.0	--				

-- = not applicable.

NA = not available.

¹ Compound growth rate.

Table 10—Production of fertilizer, derivatives, mixtures, and blends, by 14 regional cooperatives, 1959/60, 1964/65, and 1969/70

Product (except where designated as nutrient ¹)	1959/60	1964/65	1969/70	Compound growth rate, 1960-70
<hr/>				
	<hr/> 1,000 tons <hr/>			
Nitrogen:				
Ammonium nitrate—solid	260.3	557.3	1,034.0	14.8
Nitrogen solutions:				
32% N and under	37.0	210.0	520.9	30.0
Over 32% N	9.0	149.0	173.0	34.0
Ammonium sulfate—synthetic	51.0	187.0	167.0	12.6
Urea for fertilizer—solid:	11.1	25.4	198.0	33.0
Aqua ammonia	12.0	35.4	57.9	17.0
	<hr/>	<hr/>	<hr/>	<hr/>
Total	380.4	1,163.8	2,150.8	18.9
Urea for feed—solid	0.7	5.8	25.8	43.0
<hr/>				
	<hr/> Tons <hr/>			
Phosphate:				
Triple or concentrated superphosphate (P ₂ O ₅)	0	0	700.0	0
Diammonium phosphate	24.0	103.0	1,286.0	49.0
Other ammonium phosphates	74.0	204.0	269.0	13.8
Nitric phosphate	0	0	11.0	0
	<hr/>	<hr/>	<hr/>	<hr/>
Total	98.0	307.0	2,266.0	38.0
<hr/>				
	<hr/> Tons <hr/>			
Superphosphoric acid for feed (P ₂ O ₅)	0	0	156.0	0
<hr/>				
	<hr/> 1,000 tons <hr/>			
Mixtures and blends:				
Dry chemical mixtures	2,173.3	2,273.9	2,366.3	0.8
Dry bulk blends	168.8	395.4	581.8	13.2
Liquid mixtures	35.0	42.0	89.1	9.8
	<hr/>	<hr/>	<hr/>	<hr/>
Total	2,377.1	2,711.3	3,037.2	2.5

products (table 9). Their combined capacity was 27 percent of the industry total. By 1972, cooperative capacity had increased to 1,300,000 tons, or 36 percent of U.S. capacity. In 1960, only two cooperatives had a combined capacity of 303,000 tons. The first cooperative plant to produce solid ammonium nitrate was built in 1951 at Yazoo City, Miss.

The cooperative plants produced 1,034,000 tons of solid ammonium nitrate products in 1969/70; 557,300 tons in 1964/65; and 260,300 tons in 1959/60 (table 10). Cooperatives' share of U.S. production was 32.5 percent in 1969/70,

compared with 26 percent 10 years earlier (table 11).

Hereafter, see table 9 in reference to plant capacity and tables 10 and 11 in reference to production or output.

Nitrogen Solutions—32-Percent N and Under—In 1970, six cooperatives had 10 facilities with capacities totaling 850,000 tons of liquid materials a year. Their capacity was about the same in 1972. Data on industry plants were not available. Only one cooperative had such facilities in 1960. The first cooperative plant to

Table 11—Production of fertilizer derivatives in terms of nutrients by all firms and by cooperatives, and cooperative share of production, 1959/60, 1964/65, and 1969/70

Nutrient	1959/60			1964/65			1969/70		
	All firms	Cooperatives		All firms	Cooperatives		All firms	Cooperatives	
		Total	Percent of all firms		Total	Percent of all firms		Total	Percent of all firms
Nitrogen (N): 1,000 tons 1,000 tons	Percent 1,000 tons 1,000 tons	Percent 1,000 tons 1,000 tons	Percent
Ammonium nitrate—solid	1335.0	87.2	26.0	726.4	186.7	24.5	1,065.9	346.4	32.5
Nitrogen solutions:									
32% & under	815.0	11.1	1.8	366.7	63.2	17.2	933.5	156.3	16.7
Over 32%		3.3		706.2	55.1	7.8	631.7	50.7	8.0
Ammonium sulfate (synthetic)	212.0	10.7	5.1	² 359.0	39.3	10.9	163.8	35.1	21.4
Urea for fertilizer—solid:	130.8	5.1	3.9	267.7	11.7	4.4	609.0	89.1	14.6
Aqua ammonia	NA	2.4	NA	NA	7.1	NA	NA	11.6	NA
Total	1,492.8	119.8	7.8	2,426.0	363.1	14.7	3,403.9	689.2	20.2
Urea for feed—solid	45.4	.3	.1	58.5	2.7	4.6	151.2	11.9	7.9
Phosphates (P ₂ O ₅):									
Triple or concentrated superphosphate	935.0	0	0	1,305.1	0	0	1,318.1	322.0	24.4
Ammonium phosphates	245.8	31.3	12.7	1,000.0	105.5	10.6	1,926.4	675.3	35.1
Total P ₂ O ₅	1,180.8	31.3	2.7	2,305.1	105.5	4.6	3,244.5	997.3	30.7

NA = not available.

¹ Estimate based on 1,584.889 tons of product in 1961/62—the 1st year for which data were available.

² Includes considerable amount of chemical byproducts.

produce nitrogen solutions was built at Lawrence, Kans., in 1955.

In 1969-70, cooperatives produced 520,900 tons of nitrogen solutions (32-percent N and under), which was about 17 percent of the domestic total.

Nitrogen Solutions—Over 32 Percent—In 1970, three cooperatives had four plants with a combined capacity of about 298,000 tons of liquid materials a year. Their total was slightly less in 1972. Only one cooperative plant—with a 23,000-ton capacity—was producing solution in 1960.

Cooperatives produced 173,000 tons of solutions containing over 32-percent nitrogen in 1969/70—only 8 percent of the U.S. total.

Ammonium Sulfate—One cooperative operated one synthetic ammonium sulfate plant in 1970; its design capacity was 290,000 tons a year, or 9 percent of the U.S. total capacity for both synthetic and byproduct materials. In 1960, the only cooperative plant had a capacity of 145,000 tons a year. The first cooperative plant to produce ammonium sulfate was built at Helm, Calif.; another plant started operations after 1970.

Cooperatives produced 167,000 tons of synthetic ammonium sulfate in 1969/70. Production increased from 5 percent of the U.S. synthetic output in 1959/60 to 21 percent in 1969/70.

Urea—Solid—In 1970, four cooperatives operated five plants with design capacities totaling about 499,000 tons of solid urea—or about 19 percent of the total U.S. capacity. The first cooperative urea plant—with a capacity of 46,000 tons a year—was built at Yazoo City, Miss., in 1960.

In 1969/70, cooperatives produced 198,000 tons of solid urea for fertilizer use and 25,800 tons for feed. These outputs comprised 15 and 8 percent of the respective total U.S. outputs. Cooperatives produced only small amounts 5 and 10 years earlier.

Urea—Solution (100%)—In 1970, four cooperatives had five plants with a combined capacity of 342,600 tons for producing urea solutions, or about 23 percent of U.S. capacity.

In 1972, cooperative capacity was 354,500 tons. Only two cooperative plants, with a combined 26,500-ton capacity, were operating in 1960.

Data on quantity of urea solutions produced by cooperatives were not obtained.

Aqua Ammonia—Cooperatives reported producing 57,900 tons of aqua ammonia in 1969/70, compared with 12,000 tons in 1959/60. Data on total production in the country were not available.

Total Nitrogen—Cooperative production accounted for about 20 percent of total U.S. nitrogen fertilizer produced in 1969/70, compared with 15 percent in 1964/65 and 8 percent in 1959/60.

Straight Phosphate Materials

Triple Superphosphate—On January 1, 1970, two cooperatives had three triple superphosphate plants with total capacities of 409,000 tons of P_2O_5 —about 21 percent of total U.S. capacity. Cooperative capacity declined to 340,000 tons in 1972. Farmers constructed the first cooperative plant to produce triple superphosphate in Joplin, Mo., in 1954.

Cooperative production was 700,000 tons of P_2O_5 in 1969/70—24 percent of the U.S. total.

Ammonium Phosphates—On January 1, 1970, four cooperatives operated five plants with a combined capacity of 1,283,500 tons of ammonium phosphates—40 percent of the U.S. total. Three were diammonium phosphate plants and one was a nitric phosphate plant. Recent reports show cooperative capacity at the beginning of 1972 was 1,444,000 tons, or 51 percent of U.S. capacity.

Three cooperative plants had a combined capacity of 179,000 tons in 1960. The first cooperative plant to produce ammonium phosphates was built in 1954 at Joplin, Mo.

Owing to recent acquisitions and expansion, cooperatives were able to produce 1,286,000 tons of diammonium phosphate, 269,000 tons of other ammonium phosphates, and 11,000 tons of nitric phosphate in 1969/70. Combined, this comprised about 35 percent of the total produced in the United States, compared with 13 percent in 1959/60.

Superphosphoric Acid—One cooperative produced 156,000 tons of superphosphoric acid for feed use in 1969/70. None was reported produced in earlier periods.

Total Phosphates—In 1969/70, cooperatives produced about 2,422,000 tons of phosphates—31 percent of the U.S. total. Cooperative production was only 3 percent of the total in 1959/60 and 5 percent in 1964/65.

Chemical Mixtures and Blends

As mentioned earlier, the cooperatives in this study have operated chemical dry-mixing and ammoniating plants for many years. More recently, they have acquired liquid-mixing and bulk-blending plants at a rapid rate. Lists of individual plants are in appendix tables 3, 4, and 5. Data in this section do not include numerous plants owned by local cooperatives and dealer-agents affiliated with cooperatives in this study.

Dry Mixtures—In 1970, 22 cooperatives operated 61 chemical dry-mixing plants with

design annual capacities of 3,482,000 tons of product (table 12). Capacity had declined to 2,951,000 by 1972. Over 85 percent of this capacity was owned by the larger regional cooperatives that also produced and distributed basic fertilizer materials. The capacity of 81 cooperative plants in 1960 was 3,716,000 tons. The number of plants decreased because of conversion to bulk-blending operations; in a few cases, mixing operations were consolidated into fewer and larger plants.

The first cooperative mixing plant—with an annual capacity of 20,000 tons—began operating in Caribou, Maine, in 1920. One other cooperative started mixing operations in the 1920's; seven started in the 1930's; and six started in the 1940's.

Cooperatives produced 2,366,300 tons of dry-mixed fertilizers in 1969/70—or about 14 percent of the U.S. total (tables 10 and 14). Their percentage was about the same in 1959/60.

Bulk Blends.—Fourteen regional cooperatives operated 214 dry-blending plants with design

Table 12—Design annual capacity of chemical dry-mixing, liquid-mixing, and dry bulk-blending fertilizer plants on January 1, 1960, 1965, and 1972

Product and year	Total capacity	Growth rate, 1960-70
	<u>1,000 tons</u>	<u>Percent</u>
Dry chemical mixtures (product):		
1960	3,716.0	--
1965	3,526.0	--
1970	3,182.0	-1.5
1972	2,951.0	--
Liquid mixtures (product):		
1960	78.0	--
1965	78.0	--
1970	167.0	7.9
Bulk blends (product):		
1960	206.0	--
1965	703.0	--
1970	941.0	16.4

-- = not applicable.

Table 13—Design annual capacity for industry and cooperative plants producing acids and other products; their production; and the cooperative share of the total, selected years, 1960-72

Product and year	Capacity on January 1				Production		
	All firms	Cooperatives		All firms	Cooperatives		
		Total	Percent of all firms		Total	Percent of all firms	
	----- 1,000 tons -----		Percent	----- 1,000 tons -----		Percent	
Nitric acid (NHO ₃) ¹ (100-percent acid):							
1960	4,174.0	276.5	6.6	3,208.0	270.2	8.4	
1965	6,429.0	704.0	11.0	4,803.7	784.5	16.3	
1970	9,400.0	1,267.4	13.5	6,480.1	1,148.2	17.7	
1972	NA	1,500.4	NA	NA	NA	NA	
	----- 1,000 tons -----		Percent	----- 1,000 tons -----		Percent	
Growth rate, 1960-70 ²	8.4	14.9	--	7.3	15.6	--	
Sulfuric acid (H ₂ SO ₄):	----- 1,000 tons -----		Percent	----- 1,000 tons -----		Percent	
1960	22,570.0	200.0	0.9	17,186.7	210.3	1.2	
1965	25,083.0	249.0	1.0	22,502.3	472.9	2.1	
1970	38,000.0	3,503.0	9.2	27,572.6	3,466.5	12.6	
1972	NA	4,036.0	NA	NA	NA	NA	
	----- 1,000 tons -----		Percent	----- 1,000 tons -----		Percent	
Growth rate, 1960-70	5.3	35.0	--	4.9	32.0	--	
Hydrofluosilicic acid:	----- 1,000 tons -----		Percent	----- 1,000 tons -----		Percent	
1970	NA	4.5	NA	NA	NA	NA	
1972	NA	21.5	NA	NA	NA	NA	
Carbon dioxide:	----- 1,000 tons -----		Percent	----- 1,000 tons -----		Percent	
1970	NA	35.0	NA	NA	NA	NA	
1972	NA	105.0	NA	NA	NA	NA	

-- = not applicable.

¹ Excludes ordnance capacity.

² Compound growth rate.

NA = not available.

annual capacities of 941,000 tons in 1970. Ten years earlier, their capacity was only 206,000 tons. These regional cooperatives produced 581,800 tons of bulk blends in 1969/70, compared with 168,800 tons in 1959/60.

Liquid Mixtures.—Nine regional cooperatives reported operating nine liquid-mixed product plants with design annual capacities of 167,000 tons in 1970. Cooperative capacity was 78,000 tons in 1960.

In 1969/70, these cooperatives produced 89,100 tons of liquid mixtures—about 4 percent of the total liquids used in the United States that year. Cooperative output was only 35,000 tons in

1959/60. Several cooperatives also produced liquid mixtures of nitrogen products.

Acids and Other Products

Cooperatives have acquired several facilities that produce nitric acid, which is used in manufacturing solid nitrogen fertilizers, and sulfuric acid, which is used in manufacturing phosphate fertilizers. Three cooperatives have recently installed facilities to use byproducts from manufacturing operations.

Nitric Acid.—On January 1, 1970, six cooperatives had eight nitric acid plants with a combined capacity of 1,267,400 tons a year—14 percent of the U.S. total (table 13). In 1972,

Table 14—Cooperatives' share of U.S. production of fertilizers, 1959/60, 1964/65, and 1969/70

Product or nutrient	Share of total U.S. production by cooperatives in the study ¹		
	1959/60	1964/65	1969/70
	Percent		
Basic materials:			
Anhydrous ammonia (NH ₃)	6.6	11.8	20.4
Wet phosphoric acid (P ₂ O ₅)	4.1	6.3	27.5
Normal superphosphate (P ₂ O ₅)	21.3	26.2	17.6
Potash (K ₂ O) (U.S. & Canada)	0	0	2.9
Derivatives:			
Nitrogen:			
Ammonium nitrate—solid (N)	26.0	24.5	32.5
Nitrogen solutions (N):			
32 percent and under	} 1.8	17.2	16.7
Over 32 percent		7.8	8.0
Ammonium sulfate—synthetic (N)	5.1	10.9	21.4
Urea for fertilizer—solid (N)	3.9	4.4	15.0
Total	7.8	14.7	20.2
Urea for feed—solid (N)	0.1	4.6	17.1
Phosphates:			
Triple superphosphate (P ₂ O ₅)	0	0	24.4
Ammonium phosphates (P ₂ O ₅) ²	12.7	10.6	35.1
Total	2.7	4.6	30.7
Mixtures—chemical (products): ^{1 3}			
Dry (excluding bulk blends)	14.5	13.6	13.9
Liquid	6.1	4.2	3.8
Total	14.2	13.1	12.7

¹ The share of materials produced by the cooperatives is overstated and their share of mixtures produced is understated, because the data do not include the output of bulk-blending plants operated by many local cooperatives and reported as mixtures.

² Includes liquids and nitric phosphate.

³ Cooperative production was compared with total U.S. use because data on total production were not available.

capacity was 1,500,400 tons. Only three had plants in 1960 and their capacity was 276,500 tons, or 7 percent of the U.S. total. The first cooperative plant to produce nitric acid was built at Yazoo City, Miss., in 1951.

In 1969/70, cooperatives produced 1,148,200 tons of nitric acid—18 percent of the U.S. total, compared with 8 percent 10 years earlier.

Sulfuric Acid.—Four cooperatives had five plants with a combined capacity of 3,503,000 tons a year—9 percent of the U.S. total (table 13). By January 1, 1972, cooperative capacity had increased to 4,036,000 tons. Only one cooperative plant, with a capacity of 200,000 tons, was operating in 1960. The first cooperative plant to produce sulfuric acid was built at Pascagoula, Miss., in 1957.

Cooperative production of sulfuric acid totaled 3,466,500 tons in 1969/70—about 13 percent of total domestic production—compared with 1 percent in 1959/60.

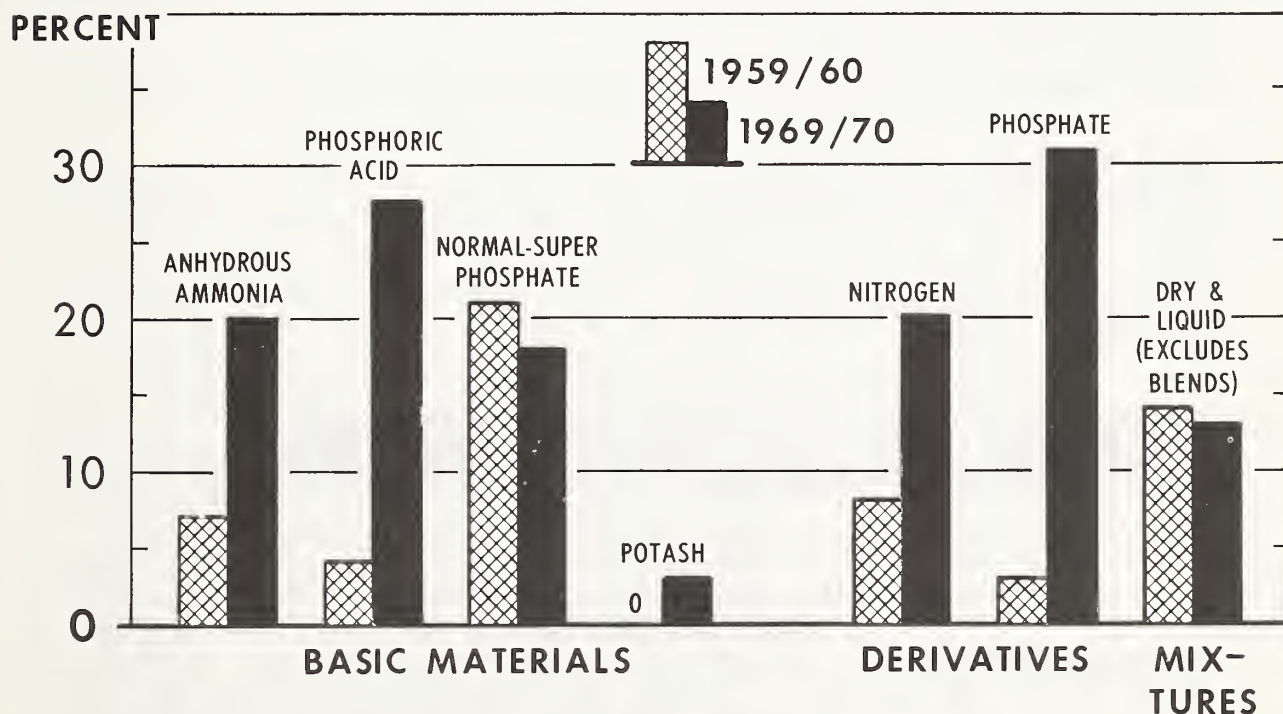
Hydrofluosilicic Acid.—On January 1, 1970, one cooperative operated a small hydrofluosilicic acid plant to recover fluorine released during the concentration of phosphoric acid. By January 1, 1972, three cooperative plants with an annual capacity of 21,500 tons were in operation.

Carbon Dioxide.—Carbon dioxide is a byproduct of anhydrous ammonia production. Merchant CO₂ was produced in 1970 by cooperatives at two locations in the United States. Total plant capacity was 35,000 tons in 1970 and 105,000 tons in 1972.

Cooperatives' Share of U.S. Fertilizer Production, and Percentage of Their Sales Produced in Own Plants

Table 14 and figure 2 summarize the percentage of U.S. output of fertilizer basic materials and derivatives that cooperative plants

FIG. 2 COOPERATIVE SHARE OF U. S. FERTILIZER PRODUCTION



produced in 1959/60, 1964/65, and 1969/70. Of the U.S. total in 1969/70, cooperatives produced about 20 percent of the anhydrous ammonia, 28 percent of the wet phosphoric acid, 18 percent of the normal superphosphate, and 3 percent of the potash (in U.S. and Canada). They also produced 20 percent of the N in derivatives; 31 percent of P_2O_5 in derivatives; and 17 percent of the chemical mixtures that year.

Data were not obtained on the quantity of basic materials manufactured by cooperatives that they used in producing derivatives and mixtures, nor the percentage of the sales volume of each cooperative that was produced in its own plants. Therefore, the total N, P, and K nutrients sold by cooperatives in 1969/70 were calculated (allowing for extra phosphoric acid required in producing normal superphosphate, diammonium phosphate, and ammonium phosphates); and from these calculations, the percentage of each nutrient that was produced in cooperative plants was computed.

These calculations indicated that the cooperatives in this study produced over

2,188,600 tons of N—87 percent of their total sales of this nutrient in 1969/70 (table 15). They produced 1,210,800 tons of P_2O_5 —73 percent of their sales; and 180,000 tons of K_2O —16 percent of their sales. Therefore, their production of nutrients was 67 percent of their total sales of nutrients in 1969/70.

If this percentage is applied to the 12.5 million tons of fertilizer materials or products cooperatives sold at retail in 1969, their production of materials was about 813 million tons (fig. 3). This production, however, cannot be compared with the tonnage cooperatives wholesaled because much of the output of one large manufacturing cooperative was sold directly to farmers.

PRIMARY DISTRIBUTION STORAGE

The fertilizer industry is highly seasonal; 40 percent of annual consumption moves in the 6-week spring planting period. Seventy-five percent often moves within a 6-month period.

FIG. 3 INTEGRATED FERTILIZER OPERATIONS OF FARMER COOPERATIVES

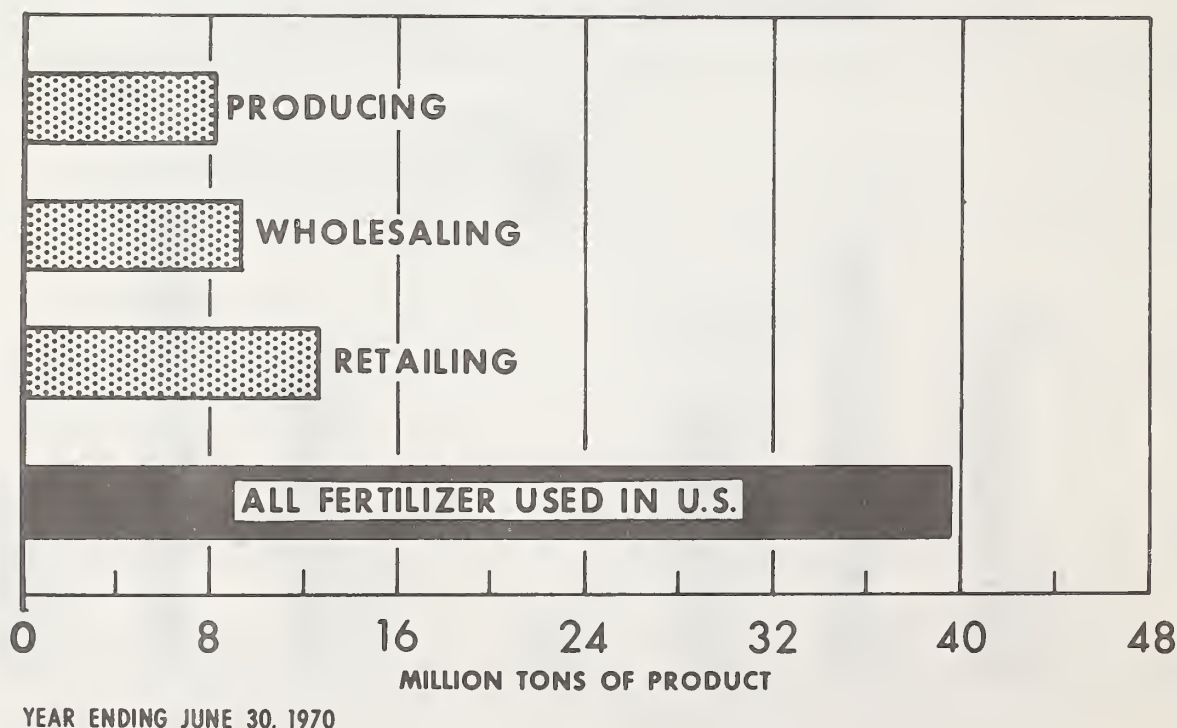


Table 15—Cooperative's sales of plant nutrients produced in own plants, 1969/70

Nutrient	Quantity sold	Quantity produced	Share of sales
	1,000 tons		Percent
Nitrogen (N)	2,514.6	2,188.6	87.0
Phosphate (P ₂ O ₅)	1,659.8	1,210.8	72.9
Potash (K ₂ O)	1,099.7	180.0	16.4
Total	5,274.1	3,579.4	66.5

Operating production facilities year-round to achieve low production costs results in the need to store up to two-thirds of the annual plant output before the spring season.

Since most basic production facilities are far from the principal U.S. farming areas, a distribution system is required to deliver fertilizer from plant to farm gate. Shipping fertilizer to regional storage facilities during the off-season is more desirable than storing large quantities at basic producing plants and then trying to ship the fertilizer to local markets during a very short sales period. For this reason, storage capacity for fertilizer has been highly integrated with distribution and marketing activities. Cooperatives have led in establishing fertilizer storage and distribution systems to ensure service

to farmers. Their storage capacities are described below.

Liquid Storage

In 1970, eight cooperatives reported 347,900 tons of storage capacity for liquid products at primary distribution points (other than at plants) (table 16). About two-thirds of this was for anhydrous ammonia and one-third was for nitrogen solutions. Almost all these facilities have been acquired since 1965.

Dry Storage

Five cooperatives had 882,700 tons of storage capacity for dry fertilizers at primary distribution points in 1970 (table 16). The largest amount was for mixtures, followed by phosphates and

Table 16—Design capacity of primary distribution storage for fertilizer (exclusive of plant storage) operated by cooperatives, 1960, 1965, and 1970¹

Type of storage and fertilizer	1960	1965	1970	Compound growth rate, 1960-70
	1,000 tons			Percent
Liquid storage terminals:				
Anhydrous ammonia	1.2	4.6	229.4	²
Nitrogen solution	0	44.0	118.5	²
Total liquid	1.2	48.6	347.9	²
Dry storage warehouses:				
Nitrogen	11.9	15.4	132.6	27.0
Phosphates	2.0	5.5	214.5	²
Potash	2.0	6.1	87.3	46.0
N-P-K mixtures	159.5	249.7	448.3	10.9
Total dry	175.4	276.7	882.7	17.5
Total storage	176.2	325.3	1,230.6	21.0

¹ 8 cooperatives reported having liquid storage terminals and 5 operated dry storage warehouses in 1970.

² Not calculated because of low bases in 1960.

Table 17—Investment by cooperatives in manufacturing, primary storage, and mixing facilities, 1970¹

Type of facilities	Plants or facilities	Cost	Depreciated value
	Number	1,000 dollars	
Manufacturing:			
Nitrogen	52	297,947	200,514
Phosphate	29		
Potash	1	143,358	92,444
Subtotal	82	441,305	292,954
Primary storage:			
Liquid	100	13,125	9,079
Dry	13	10,760	5,280
Subtotal	113	23,885	14,359
Total	195	465,190	307,313
Mixing and blending:			
Chemical dry mixing	34	45,209	21,123
Bulk blending	238	14,253	8,567
Liquid mixing	65	1,816	892
Subtotal	337	61,278	30,582
Storage			
Liquid	125	1,095	618
Dry	20	2,188	778
Subtotal	145	3,283	1,396
Total	482	64,561	31,978

¹ In fiscal year ending in 1970. Data reported for 14 cooperatives engaged in manufacturing, 10 with primary storage, and 29 engaged in mixing and blending.

nitrogen materials. Much of the increase in storage has been built since 1965.

COOPERATIVES' INVESTMENTS IN FERTILIZER FACILITIES AND OPERATIONS

Farmers, through their cooperatives, have large investments in plants and equipment to produce, store, and distribute the plant food they need for the successful operation of their farms.

Production and Primary Distribution

The 14 regional cooperatives in this study reported that by the end of their 1970 fiscal year, they had invested over \$465 million in fertilizer manufacturing plants and primary distribution storage facilities (table 17). The depreciated value of the facilities was \$307 million. Nitrogen facilities accounted for about two-thirds and phosphate facilities for about one-fourth of the total.

Cooperatives' investments in dry mixing, bulk blending, liquid mixing, and storage facilities

totaled \$64.6 million at cost value and \$32 million at depreciated values by the end of 1970 (table 17).

Data were not obtained on working capital used, but rough estimates indicate that it may amount to about 50 percent of the net fixed assets, or \$170 million.

Local Marketing

Data were not obtained on capital invested or used for local facilities and working capital. However, using average installed costs for local types of warehouse facilities and equipment and adjusting these data to 1965 as the average year of installation, a total of \$308 million was computed for 1970. This total, depreciated at 12 percent a year, was \$123 million in 1970.

Operating capital is estimated at \$300 million—twice that for manufacturing and primary distribution storage. It is about equal to the cost of facilities and 2.5 times their depreciated value.

The combined working capital of \$450 million amounts to 72 percent of the \$657 million of net cooperative fertilizer sales estimated

for 1969/70. (Some industry studies indicate that average working capital amounts to about 66 percent of sales.)

Total Capital Used

The foregoing data and estimates indicate that in 1970 cooperative had about \$818 million invested in fertilizer facilities, at cost values, and \$452 million at depreciated values. Adding \$470

million as average working capital gives a gross total of almost \$1.3 billion and a net total of \$922 million. This net was equal to about \$500 per farmer-member purchasing fertilizer through cooperatives.

The relation of capital used in manufacturing to that in marketing is about one to one for both gross and net amounts. A recapitulation of these figures is as follows:

Type of capital	Basic manufacturing, mixing, & distribution	Local marketing 1,000 dollars	Total
Gross fixed assets	510.4	307.9	818.3
Working capital	170.0	300.0	470.0
Total	680.4	607.9	1,288.3
Net fixed assets	328.4	123.2	451.6
Working capital	170.0	300.0	470.0
Total	498.4	423.2	921.6

EMPLOYEES ENGAGED IN FERTILIZER OPERATIONS

The 39 cooperatives' manufacturing and marketing fertilizer employ many people; most of them live in small cities in rural areas. On January 1, 1971, an estimated total of 22,655 employees were engaged in fertilizer production and marketing (table 18). Of this total, 11,885 worked full time; 4,247 of these were engaged in

manufacturing and primary distribution and the other 7,638 were in mixing and local marketing operations.

There also were 10,770 employees working part time distributing fertilizer and part time handling feed, seed, and other supplies. Thus, 4,247 employees were engaged in manufacturing and primary distribution and 18,408 were engaged in local marketing at the beginning of 1971.

Table 18—Employees of 39 cooperatives engaged in fertilizer operations, January 1, 1971

Type of employees and operations	Number
Full-time employees:	
Manufacturing basic materials	3,263
Primary distribution	151
Administrative, office, and other	833
Subtotal—manufacturing and primary distribution	4,247
Chemical mixing and bulk blending	2,363
Wholesale distribution	468
Retail distribution and local bulk blending	4,807
Subtotal—marketing	7,638
Total full-time	11,885
Shared-time employees:	
Local distribution of fertilizer, feed, seed, and other supplies	10,770
Total employees	22,655

APPENDIX – SUPPORTING TABLES

Appendix table 1—Design annual capacity of plants of cooperatives producing basic fertilizer materials, 1960, 1965, 1970 and 1972¹
(340 days per year)

Product or nutrient, cooperative, and location of plant	Annual capacity on January 1			
	1960	1965	1970	1972
	<u>1,000 tons</u>			
<i>Anhydrous ammonia (NH₃):</i>				
CF Industries, Inc.—				
Donaldsonville, La.	0	0	700.0	700.0
Fremont, Nebr. ²	0	44.0	48.0	48.0
Terre Haute, Ind.	0	0	0	137.0
Central Nitrogen, Inc.—				
Terre Haute, Ind.	0	133.0	123.0	0
Cooperative Farm Chemicals Assoc.— ³				
Lawrence, Kans.	98.0	195.0	195.5	350.0
Farmland Industries, Inc.— ⁴				
Dodge City, Kans.	0	0	200.0	200.0
Ft. Dodge, Iowa	0	0	200.0	200.0
Hastings, Nebr.	0	152.0	152.0	152.0
Farmers Chemical Assoc.—				
Tyner, Tenn.	0	165.0	175.0	175.0
Tunis, N.C.	0	0	200.0	200.0
Mississippi Chemical Corporation— ⁵				
Yazoo City, Miss.	112.0	115.0	0	0
Coastal Chemical Corporation— ⁵				
Pascagoula, Miss.	150.0	180.0	0	0
Mis Coa, Inc.— ⁶				
Yazoo City, Miss.	0	0	350.0	350.0
Pascagoula, Miss.	0	0	180.0	180.0
Triad Chemical Co.— ⁷				
Donaldsonville, La.	0	0	175.0	175.0
Southern Farm Supply Assoc.—				
Plainview, Tex.	0	21.0	0	0
Valley Nitrogen Producers, Inc.—				
Helm, Calif.	60.0	176.0	176.0	166.0
El Centro, Calif. ⁸	0	0	210.0	190.0
Chandler, Ariz.	0	0	0	33.0
Total—all plants	322.0	1,181.0	3,084.0	3,256.0
Total—daily(@ 340 days a yr.)	947.1	3,473.5	9,070.6	9,576.5
Number of plants	3	9	14	14
See footnotes at end of table				

Continued

Appendix table 1—Design annual capacity of plants of cooperatives producing basic fertilizer materials,
1960, 1965, 1970 and 1972¹ —Continued
(340 days per year)

Product or nutrient, cooperative, and location of plant	Annual capacity on January 1			
	1960	1965	1970	1972
	<u>1,000 tons</u>			
<i>Wet process phosphoric acid (P₂O₅)</i>				
Northwest Cooperative Mills (later Cenex, Inc.)— Pine Bend, Minn.	0	35.0	0	0
CF Industries, Inc.— Bonnie, Fla. (Bartow)	0	0	570.0	640.0
Plant City, Fla.	0	0	0	210.0
Central Phosphates, Inc.— Plant City, Fla.	0	0	208.0	0
Farmland Industries— Joplin, Mo.	0	0	50.0	0
Green Bay, Fla. ¹⁰	0	0	220.0	220.0
Farmers Chemical Co.— Joplin, Mo.	25.0	50.0	0	0
Coastal Chemical Corp.— Pascagoula, Miss.	29.0	60.0	0	0
Mis Coa, Inc.— Pascagoula, Miss.	0	0	160.0	160.0
Farmers Chemical Assoc.— ¹¹ Tunis, N.C.	0	0	0	60.0
Valley Nitrogen Producers, Inc.— Helm, Calif.	<u>50.0</u>	<u>80.0</u>	<u>120.0</u>	<u>40.0</u>
Total—all plants	104.0	225.0	1,328.0	1,330.0
Number of plants	3	<u>Number</u> 4	6	6
<i>Elemental phosphorous (product):</i>				
Central Farmers Fertilizer Co.— Georgetown, Idaho	23.0	closed	--	--
<i>Normal superphosphate (P₂O₅)</i>				
Centrala Farmers Cooperative— Forkland, Ala.	0	6.0	6.0	6.0
Selma, Ala.	4.0	0	0	0
Mississippi Federated Cooperatives (1960) ^{1 2}				
Coastal Chemical Corporation (1965) ¹²				
Mis Coa, Inc. (1970 and 1972)— ¹²				
Canton, Miss.	36.0	55.0	55.0	¹³ 0
Hattiesburg, Miss.	45.0	55.0	55.0	0
See footnotes at end of table				Continued

Appendix table 1—Design annual capacity of plants of cooperatives producing basic fertilizer materials,
1960, 1965, 1970 and 1972¹ —Continued
(340 days per year)

Product or nutrient, cooperative and location of plant	Annual capacity on January 1			
	1960	1965	1970	1972
	1,000 tons			
Meridian, Miss.	36.0	55.0	55.0	0
North Albany, Miss.	<u>45.0</u>	<u>55.0</u>	<u>55.0</u>	<u>0</u>
Total	166.0	220.0	220.0	6.0
Farm Bureau Services— Harger, Mich. (P.O. Saginaw, Mich.)	6.0	6.0	6.0	0
Farmland Industries— Muskogee, Okla.	20.0	20.0	0	0
St. Joseph, Mo.	20.0	20.0	0	0
FS Services, Inc.— E. St. Louis, Ill.	20.0	20.0	0	0
Prairie du Chien, Wis.	40.0	40.0	40.0	0
Gold Kist, Inc. (formerly Cotton Producers Assoc.)— Cordele, Ga.	25.0	25.0	25.0	25.0
Carrollton, Ga.	25.0	25.0	0	0
Clyo, Ga.	<u>0</u>	<u>0</u>	<u>25.0</u>	<u>25.0</u>
Total	50.0	50.0	50.0	50.0
Landmark, Inc. (formerly Farm Bureau Coop. Assoc.)— Dayton, Ohio	29.0	29.0	29.0	0
Indiana Farm Bureau Coop. Assoc.— Indianapolis, Ind.	50.0	50.0	50.0	50.0
New Albany, Ind.	30.0	30.0	closed	--
Hartsdale, Ind. (Co-op Plant Foods)	30.0	closed	--	--
Southern States Cooperative— Winchester, Ky.	10.0	10.0	10.0	10.0
Southern Farm Supply Assoc.— Sulphur Springs, Tex.	20.0	0	0	0
Tennessee Farmers Cooperative— La Vergne, Tenn.	50.0	50.0	0	0
Knoxville, Tenn.	50.0	50.0	0	0
Jackson, Tenn.	<u>0</u>	<u>0</u>	<u>50.0</u>	<u>50.0</u>
Total—all plants	591.0	601.0	461.0	166.0

See footnotes at end of table

Continued

Appendix table 1—Design annual capacity of plants of cooperatives producing basic fertilizer materials,
1960, 1965, 1970 and 1972¹ —Continued
(340 days per year)

Product or nutrient, cooperative, and location of plant	Annual capacity on January 1			
	1960	1965	1970	1972
Number of plants	20	18	13	6
<i>Potash (K₂O):</i>				
CF Industries, Inc.—				
Viscount, Saskatchewan ¹⁴	0	0	900.0	900.0

-- = not applicable.

¹ Annual capacity data may vary from those in other tables or reports due to time of the year reported, number of operating days used, and different respondents within the cooperative.

² Formerly owned by Fel-tex, Inc., a subsidiary of Farmers Regional Cooperative, Ft. Dodge, Iowa.

³ A majority-owned subsidiary of Farmland Industries, Inc.

⁴ Announced in July, 1972, that a new plant with an annual capacity of 380,000 tons will be built in Enid, Okla.—to be completed in 1974.

⁵ Mississippi Chemical Corporation and Coastal Chemical Corporation were merged under the former's name on July 1, 1972.

⁶ Owned by Mississippi Chemical Corp. and Coastal Chemical Corp.

⁷ 50 percent owned by Mis Coa and 50 percent owned by First Mississippi Corp. Cooperative capacity was 50 percent of total capacity.

⁸ Capacity based on 7 months operation per year.

⁹ Ammonia capacity of 33,000 tons at Chandler, Ariz., was discontinued on October 1, 1971.

¹⁰ A second plant with 255,000 tons capacity was completed in 1972. It will produce 54 percent phosphoric acid and 72 percent superphosphoric acid. Plans were announced in July 1972 to build a 250,000-ton-a-year phosphoric acid plant to be in operation in 1974.

¹¹ Nitric acid process.

¹² In 1960, Mississippi Federated owned the 4 plants. They were sold to Coastal Chemical by 1965 and, in turn, to Mis Coa by 1970 and 1972.

¹³ All plants shut down. Used for storage and bulk blending.

¹⁴ Joint venture with Central Canada Potash, Ltd., which formerly was Norando Mines, Ltd.

Appendix table 2—Design annual capacity of plants of cooperatives producing fertilizer derivatives and nitric and sulfuric acid, 1960, 1965, 1970, and 1972¹

Product or nutrient, cooperative, and location of plant	Annual capacity on January 1			
	1960	1965	1970	1972
	<u>1,000 tons</u>			
<i>Ammonium nitrate (solid; material):</i>				
Agway, Inc.— Olean, N.Y.	0	0	58.0	58.0
CF Industries, Inc.— Fremont, Nebr. ²	0	32.0	0	0
Terre Haute, Ind.	0	0	0	150.0
Central Nitrogen, Inc.— Terre Haute, Ind.	0	140.0	132.0	0
Cooperative Farm Chemicals Assoc.— ³ Lawrence, Kans.	122.5	164.0	355.0	355.0
Farmers Chemical Assoc.— Tyner, Tenn.	0	175.0	175.0	175.0
Tunis, N.C.	0	0	0	140.0
Mississippi Chemical Corp.— Yazoo City, Miss.	180.0	237.0	0	0
Mis Coa, Inc.— ⁴ Yazoo City, Miss.	0	0	325.0	380.0
Valley Nitrogen Producers— El Centro, Calif.	<u>0</u>	<u>0</u>	<u>45.0</u>	<u>42.0</u>
Total	302.5	748.0	1,090.0	1,300.0
<i>Urea (solid; material):</i>				
Agway, Inc.— Olean, N.Y.	0	0	46.6	46.6
Mississippi Chemical Corp.— Yazoo City, Miss.	14.0	30.0	0	0
Mis Coa, Inc.— Yazoo City, Miss.	0	0	52.0	30.0
Triad Chemical Co.— ⁵ Donaldsonville, La.	0	0	210.0	210.0
Valley Nitrogen Producers— Helm, Calif.	0	0	35.0	30.0
El Centro, Calif.	<u>0</u>	<u>0</u>	<u>155.0</u>	<u>140.0</u>
Total	14.0	30.0	498.6	456.6
See footnotes at end of table				Continued

Appendix table 2—Design annual capacity of plants of cooperatives producing fertilizer derivatives and nitric and sulfuric acid, 1960, 1965, 1970, and 1972¹ —Continued

Product or nutrient, cooperative, and location of plant	Annual capacity on January 1			
	1960	1965	1970	1972
	<u>1,000 tons</u>			
<i>Urea (solution—100%):</i>				
Cooperative Farm Chemical Assoc.— ³ Lawrence, Kans.	10.5	45.6	45.6	57.5
CF Industries, Inc.— ⁶ Fremont, Nebr. (Feed grade UAN solution)	0	0	2.0	2.0
Mississippi Chemical Corp.— Yazoo City, Miss.	16.0	49.0	0	0
Mis Coa, Inc.— Yazoo City, Miss.	0	0	80.0	80.0
Farmers Chemical Assoc.— Tyner, Tenn.	0	40.0	40.0	40.0
Tunis, N.C.	<u>0</u>	<u>0</u>	<u>175.0</u>	<u>175.0</u>
Total	26.5	134.6	342.6	354.5
<i>Ammonium sulfate (synthetic; material):</i>				
CF Industries, Inc.— Plant City, Fla.	0	0	0	10.0
Valley Nitrogen Producers— Helm, Calif.	<u>145.0</u>	<u>290.0</u>	<u>290.0</u>	<u>264.0</u>
Total	145.0	290.0	290.0	274.0
<i>Nitrogen solutions—32% and under (material):</i>				
Agway, Inc.— Olean, N.Y.	0	0	20.0	20.0
CF Industries, Inc.— Terre Haute, Ind. (AAN)	0	0	10.0	10.0
Terre Haute, Ind. (UAN)	0	0	20.0	30.0
Central Nitrogen, Inc.— Terre Haute, Ind. (AAN)	0	10.0	0	0
Terre Haute, Ind. (UAN)	0	20.0	0	0
CF Industries, Inc.— Fremont, Nebr. (AAN)	0	0	7.0	7.0
Fremont, Nebr. (UAN)	0	0	60.0	58.0

See footnotes at end of table

Continued

Appendix table 2—Design annual capacity of plants of cooperatives producing fertilizer derivatives and nitric and sulfuric acid, 1960, 1965, 1970, and 1972¹ —Continued

Product or nutrient, cooperative, and location of plant	Annual capacity on January 1			
	1960	1965	1970	1972
	<u>1,000 tons</u>			
Farmers Regional Cooperative—				
Fremont, Nebr. (AAN)	7.0	7.0	0	0
Fremont, Nebr. (UAN)	60.0	58.0	0	0
Cooperative Farm Chemicals Assoc.—				
Lawrence, Kans.	0	140.0	159.0	159.0
Farmers Chemical Assoc.—				
Tyner, Tenn.	0	130.0	130.0	130.0
Tunis, N.C.	0	0	300.0	300.0
Mississippi Chemical Corp.—				
Yazoo City, Miss.				
N. Sol. (32% N)	18.0	49.0	0	0
Urea liquor (20% N)	2.0	2.0	0	0
Mis Coa, Inc.—				
Yazoo City, Miss.				
N. Sol.	0	0	142.0	145.0
Urea liquor	<u>0</u>	<u>0</u>	<u>2.0</u>	<u>2.0</u>
Total	87.0	416.0	850.0	861.0
<i>Nitrogen solution—over 32% (material):</i>				
Agway, Inc.—				
Olean, N.Y.	0	0	73.7	73.7
Farmers Chemical Assoc.				
(Urea-ammonium nitrate solution)—				
Tyner, Tenn.	0	130.0	130.0	130.0
Tunis, N.C.	0	0	80.0	80.0
Mississippi Chemical Corp.—				
Yazoo City, Miss.	23.0	38.0	0	0
(Nitrosol—44.8% N)				
Mis Coa, Inc.—				
Yazoo City, Miss.	<u>0</u>	<u>0</u>	<u>14.0</u>	<u>1.0</u>
Total	23.0	168.0	297.7	284.7
<i>Triple or Concentrated Superphosphate (P₂O₅) (granular):</i>				
CF Industries, Inc.—				
Bonnie, Fla. (Bartow)	0	0	25.0	0
<i>See footnotes at end of table</i>				

Continued

Appendix table 2—Design annual capacity of plants of cooperatives producing fertilizer derivatives and nitric and sulfuric acid, 1960, 1965, 1970, and 1972¹ —Continued

Product or nutrient, cooperative, and location of plant	Annual capacity on January 1			
	1960	1965	1970	1972
	1,000 tons			
Plant City, Fla.	0	0	184.0	140.0
Farmland Industries, Inc.— Green Bay, Fla.	<u>0</u>	<u>0</u>	<u>200.0</u>	<u>200.0</u>
Total	0	0	409.0	340.0
<i>Run of pile:</i>				
CF Industries, Inc.— Plant City, Fla.	0	0	0	27.0
<i>Ammonium phosphates (P₂O₅):</i>				
CF Industries, Inc.— Bonnie, Fla.	0	0	450.0	450.0
Coastal Chemical Corp.— Pascagoula, Miss.	30.0	58.0	0	0
Mis Coa, Inc.— Pascagoula, Miss.	0	0	153.0	200.0
Farmland Industries— Green Bay, Fla.	0	0	264.5	400.0
Joplin, Mo.	0	0	200.0	125.0
Farmers Chemical Co.— Joplin, Mo.	77.0	150.0	0	0
Cooperative Farm Chemicals Assoc.— ³ Lawrence, Kans.	0	146.0	0	0
Northwest Co-op Mills— Pine Bend, Minn.	0	100.0	0	0
Valley Nitrogen Producers— Helm, Calif.	72.0	90.0	216.0	190.0
Chandler, Ariz.	<u>0</u>	<u>0</u>	<u>0</u>	<u>79.0</u>
Total	179.0	544.0	1,283.5	1,444.0
<i>Nitric phosphate (material):</i>				
Farmers Chemical Assoc.— Tunis, N.C.	0	0	300.0	300.0
<i>Nitric acid (HNO₃) 100% acid:</i>				
Agway, Inc.— Olean, N.Y.	0	0	46.4	46.4
See footnotes at end of table				Continued

Appendix table 2—Design annual capacity of plants of cooperatives producing fertilizer derivatives and nitric and sulfuric acid, 1960, 1965, 1970, and 1972¹ —Continued

Product or nutrient, cooperative, and location of plant	Annual capacity on January 1			
	1960	1965	1970	1972
	<u>1,000 tons</u>			
CF Industries, Inc.— Terre Haute, Ind.	0	0	28.0	28.0
Fremont, Nebr.	0	0	135.0	135.0
Farmers Chemical Assoc.— Tyner, Tenn.	0	180.0	180.0	180.0
Tunis, N.C.	0	0	180.0	360.0
Cooperative Farm Chemicals Assoc.— Lawrence, Kans.	122.5	300.0	353.0	353.0
Mississippi Chemical Corp.— Yazoo City, Miss.	147.0	224.0	0	0
Mis Coa, Inc.— Yazoo City, Miss.	0	0	310.0	365.0
Valley Nitrogen Producers— El Centro, Calif.	<u>7.0</u>	<u>0</u>	<u>35.0</u>	<u>33.0</u>
Total	276.5	704.0	1,267.4	1,500.4
<i>Sulfuric acid (H₂SO₄) 100% acid:</i>				
Farmland Industries, Inc.— Green Bay, Fla.	0	0	628.0	856.0
CF Industries, Inc.— ⁷ Bonnie, Fla.	0	0	1,641.0	1,641.0
Plant City, Fla.	0	0	537.0	537.0
Coastal Chemical Corp.— Pascagoula, Miss.	200.0	249.0	337.0	700.0
Valley Nitrogen Producers— Helm, Calif.	0	0	360.0	282.0
Chandler, Ariz.	<u>0</u>	<u>0</u>	<u>0</u>	<u>20.0</u>
Total	200.0	249.0	3,503.0	4,036.0
<i>Carbon dioxide:</i>				
Mis Coa, Inc.— Yazoo City, Miss.	0	0	0	35.0
Farmers Chemical Assoc.— Tyner, Tenn.	<u>0</u>	<u>0</u>	<u>35.0</u>	<u>70.0</u>
Total	0	0	35.0	105.0
See footnotes at end of table				Continued

Appendix table 2—Design annual capacity of plants of cooperatives producing fertilizer derivatives and nitric and sulfuric acid, 1960, 1965, 1970, and 1972¹ —Continued

Product or nutrient, cooperative, and location of plant	Annual capacity on January 1			
	1960	1965	1970	1972
	<u>1,000 tons</u>			
<i>Hydrofluosilicic acid:</i>				
CF Industries, Inc.— Plant City, Fla.	0	0	0	7.0
Mis Coa, Inc.— Pascagoula, Miss.	0	0	0	10.0
Farmland Industries, Inc.— Green Bay, Fla.	<u>0</u>	<u>0</u>	<u>4.5</u>	<u>4.5</u>
Total	0	0	4.5	21.5

¹ Annual capacity data may vary from those in other tables or reports due to time of the year reported, number of operating days used, and different respondents within the cooperative.

² Owned in 1965 by Fel-tex, Inc., a subsidiary of Farmers Regional Cooperative.

³ A majority-owned subsidiary of Farmland Industries, Inc.

⁴ Owned jointly by Mississippi Chemical Corp. and Coastal Chemical Corp.

⁵ 50 percent owned by Mis Coa and 50 percent by First Mississippi Corporation. Cooperative capacity is 50 percent of total.

⁶ Plans announced in July 1972 to build a 1,000-ton-a-day urea plant at Donaldsonville, La., to be in operation in 1974.

⁷ Plans were announced in July 1972 to build two 1,000-ton-a-day sulfuric acid plants to be in operation in 1974.

Appendix table 3—Design annual capacity of chemical dry mixing fertilizer plants of cooperatives, January 1, 1960, 1965, 1970, and 1972¹

(Based on tons of material or product)

Cooperative and location of plant	Annual capacity on January 1			
	1960	1965	1970	1972
	<u>1,000 tons</u>			
Agway, Inc.—				
Albany, N.Y. ²	30.0	35.0	60.0	60.0
Batavia, N.Y. ²	30.0	40.0	45.0	45.0
Big Flats, N.Y. ²	35.0	35.0	40.0	40.0
Bridgehampton, N.Y. ²	8.0	0.0	0.0	0.0
Canastota, N.Y. ²	25.0	3.0	3.0	3.0
Lyons, N.Y. ²	35.0	40.0	45.0	45.0
N. Collins, N.Y. ²	20.0	0.0	0.0	0.0
Riverhead, N.Y. ²	0.0	0.0	0.0	20.0
Kittaning, Pa. ³	25.0	30.0	35.0	35.0
Somerset, Pa. ³	0.0	0.0	0.0	0.0
Union City, Pa. ²	20.0	20.0	25.0	25.0
York, Pa. ³	50.0	60.0	60.0	60.0
Bridgeton, N.J. ²	10.0	7.0	7.0	7.0
Englishtown, N.J. ²	12.0	0.0	0.0	0.0
S. Kearney, N.J. ²	25.0	25.0	0.0	0.0
Yardville, N.J. ²	20.0	25.0	40.0	40.0
Wilmington, Del. ³	20.0	25.0	25.0	25.0
Cambridge, Mass. ³	25.0	25.0	0.0	0.0
Detroit, Maine ³	<u>25.0</u>	<u>25.0</u>	<u>35.0</u>	<u>35.0</u>
Total	415.0	395.0	430.0	450.0
Alabama Farmers Cooperative:				
Decatur, Ala.	50.0	0	0	0
Aroostook Federation of Farmers:				
Caribou, Maine	20.0	20.0	20.0	20.0
Ft. Kent, Maine	10.0	10.0	10.0	10.0
Centrala Farmers Cooperative:				
Selma, Ala.	2.0	0	0	0
Forkland, Ala.	0	4.0	4.0	4.0
Chewsville Cooperative Assoc.:				
Chewsville, Md.	3.0	3.0	3.0	3.0
Cumberland Valley Cooperative Assoc.:				
Shippensburg, Pa.	5.0	6.0	6.0	6.0
Farmland Industries, Inc.:				
Denver, Colo.	0	0	10.0	10.0
Eagle Grove, Iowa	25.0	25.0	25.0	0
Muskogee, Okla.	45.0	35.0	35.0	0
St. Joseph, Mo.	35.0	25.0	25.0	0
New Florence, Mo. ⁴	20.0	20.0	20.0	20.0

See footnotes at end of table

Continued

Appendix table 3—Design annual capacity of chemical dry mixing fertilizer plants of cooperatives, January 1, 1960, 1965, 1970, and 1972¹ —Continued
(Based on tons of material or product)

Cooperative and location of plant	Annual capacity on January 1			
	1960	1965	1970	1972
	1,000 tons			
Moorehead, Minn. ⁵	5.0	5.0	5.0	5.0
S. St. Paul, Minn. ⁵	25.0	25.0	25.0	25.0
Sulphur Springs, Tex. ⁶	10.0	10.0	10.0	10.0
Port Lavaca, Tex.	0	0	0	25.0
Total	165.0	145.0	155.0	95.0
Farm Bureau Services, Inc.:				
Harger, Mich.	45.0	45.0	45.0	45.0
Kalamazoo, Mich.	35.0	35.0	0	0
Farmers Coop. Fertilizer Purchasers:				
Kenbridge, Va.	25.0	25.0	25.0	25.0
Foremost Fertilizer Company:				
Leesburg, Fla.	40.0	40.0	40.0	40.0
FCX, Inc.:				
Lumberton, N.C.	30.0	50.0	50.0	50.0
Salisbury, N.C.	20.0	20.0	50.0	50.0
FS Services, Inc.:				
E. St. Louis, Ill.	70.0	70.0	0	0
Prairie du Chien, Wis. ⁷	80.0	80.0	80.0	85.0
Whitewater, Wis. ⁷	30.0	0	0	0
Green Bay, Wis. ⁷	20.0	20.0	0	0
Antigo, Wis.	15.0	15.0	0	0
Des Moines, Iowa	60.0	60.0	0	0
Total	275.0	245.0	80.0	85.0
Fertilizer Manufacturing Cooperative:				
Baltimore, Md.	80.0	80.0	0	0
Gold Kist, Inc. (Formerly Cotton Producers Assoc.):				
Adel, Ga.	25.0	25.0	0	0
Cordele, Ga.	55.0	100.0	150.0	150.0
Carrollton, Ga.	50.0	50.0	0	0
Clyo, Ga.	0	0	100.0	100.0
Savannah, Ga.	25.0	25.0	0	0
Hanceville, Ala.	0	60.0	60.0	60.0
Total	155.0	260.0	310.0	310.0

See footnotes at end of table

Continued

Appendix table 3—Design annual capacity of chemical dry mixing fertilizer plants of cooperatives, January 1, 1960, 1965, 1970, and 1972¹ —Continued
(Based on tons of material or product)

Cooperative and location of plant	Annual capacity on January 1			
	1960	1965	1970	1972
	<u>1,000 tons</u>			
Haines City Citrus Growers Assoc.: Haines City, Fla.	3.0	3.0	3.0	3.0
Hamilton Farm Bureau Coop Assoc.: Hamilton, Mich.	3.0	3.0	6.0	6.0
Indiana Farm Bureau Coop Assoc.: Indianapolis, Ind.	75.0	75.0	75.0	75.0
Briggs, Ind.	40.0	40.0	40.0	40.0
New Albany, Ind.	35.0	35.0	35.0	35.0
Hartsdale, Ind.	<u>35.0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	185.0	150.0	150.0	150.0
Landmark, Inc. (formerly Farm Bureau Cooperative Assoc.): Dayton, Ohio	100.0	100.0	0	0
Sims, Ohio	100.0	100.0	100.0	100.0
Mississippi Federated Cooperatives (1960) Coastal Chemical Corporation (1965) Mis Coa, Inc. (1970 and 1972): Pascagoula, Miss.	680.0	680.0	680.0	680.0
Canton, Miss.	48.0	48.0	48.0	0
Hattiesburg, Miss.	67.0	67.0	67.0	0
Meridian, Miss.	67.0	67.0	67.0	67.0
New Albany, Miss.	48.0	48.0	48.0	48.0
N. Little Rock, Ark.	72.0	0	0	0
Decatur, Ala.	48.0	48.0	0	0
Dothan, Ala.	<u>81.0</u>	<u>81.0</u>	<u>81.0</u>	<u>0</u>
Total	1,111.0	1,039.0	991.0	795.0
Missouri Farmers Association: Maryland Heights, Mo.	50.0	50.0	0	0
Springfield, Mo.	50.0	50.0	50.0	50.0
Palmyra, Mo.	<u>0</u>	<u>0</u>	<u>70.0</u>	<u>70.0</u>
Total	100.0	100.0	120.0	120.0
Ohio Farmers Grain & Supply Assoc.: Fostoria, Ohio	15.0	0	0	0
Pacific Supply Cooperative: Portland, Oreg.	38.4	38.4	38.4	38.4
Madras, Oreg.	38.4	38.4	38.4	38.4
Ontario, Oreg.	<u>19.2</u>	<u>19.2</u>	<u>19.2</u>	<u>19.2</u>
Total	96.0	96.0	96.0	96.0

See footnotes at end of table

Continued

Appendix table 3—Design annual capacity of chemical dry mixing fertilizer plants of cooperatives, January 1, 1960, 1965, 1970, and 1972¹ —Continued
(Based on tons of material or product)

Cooperative and location of plant	Annual capacity on January 1			
	1960	1965	1970	1972
	<u>1,000 tons</u>			
Plymouth Citrus Growers Assoc.: Plymouth, Fla.	40.0	40.0	40.0	40.0
Northwest Cooperative Mills (and later Cenex, Inc.):				
Green Bay, Wis.	50.0	50.0	0	0
Winona, Minn.	50.0	50.0	0	0
Southern States Cooperative:				
Baltimore, Md.	100.0	100.0	100.0	100.0
Chesapeake, Va. (Norfolk)	100.0	100.0	100.0	100.0
Harrisonburg, Va.	20.0	20.0	20.0	20.0
Bristol, Va.	50.0	50.0	50.0	50.0
Winchester, Ky.	26.0	26.0	26.0	26.0
Russellville, Ky.	50.0	50.0	50.0	50.0
Louisville, Ky.	<u>50.0</u>	<u>50.0</u>	<u>50.0</u>	<u>50.0</u>
Total	396.0	396.0	396.0	396.0
South Lake Apopka Citrus Growers: Oakland, Fla.	52.0	52.0	52.0	52.0
Southern Farmers Association: N. Little Rock, Ark.	<u>40.0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total—all plants	3,716.0	3,526.0	3,182.0	2,951.0
		<u>Number</u>		
Number of cooperatives	27	24	22	22
Number of plants	81	73	61	57

¹ Some cooperatives reported operating capacity based on 200 days per year. Design capacity per hour would provide more comparable data.

² Owned by Cooperative GFL Exchange, Ithaca, N.Y., in 1960.

³ Owned by Eastern States Farmers Exchange, W. Springfield, Mass., in 1960.

⁴ Owned by Farm Bureau Service Co. of Missouri, Jefferson City, until January 1, 1962.

⁵ Owned by Minnesota Farm Bureau Service Co., St. Paul, until January 1, 1968.

⁶ Owned by Southern Farm Supply Assoc., Amarillo, Tex., until April 1, 1968.

⁷ Owned by Wisconsin Farmco Service Cooperative, Madison, until September 1, 1965.

⁸ Owned by Farm Bureau Service Company of Iowa, Des Moines, until August 31, 1962.

⁹ Formerly owned by Cooperative Plant Foods, Inc., Indianapolis, Ind.

Appendix table 4—Design annual capacity of chemical liquid-mixing fertilizer plants of cooperatives, on January 1, 1960, 1965, 1970, and 1972¹
(Based on tons of material or product)

Cooperative and headquarters	Annual capacity on January 1		
	1960	1965	1970
	<u>1,000 tons</u>		
Farmland Industries, Inc.:			
Kansas City, Mo.:			
Humboldt, Iowa	20.0	20.0	20.0
Fremont, Nebr.	0	0	16.0
Farm Bureau Services:			
Lansing, Mich.	0	0	2.0
Farmers Union Central Exchange:			
St. Paul, Minn.	10.0	10.0	10.0
Indiana Farm Bureau Coop. Assoc.:			
Indianapolis, Ind.	0	0	10.0
Midland Cooperatives, Inc.:			
Minneapolis, Minn.	0	0	2.0
Mississippi Federated Cooperatives:			
Jackson, Miss.:			
Canton, Miss.	12.0	0	0
Missouri Farmers Association:			
Palmyra, Mo.	0	0	15.0
Valley Nitrogen Producers:			
Helm, Calif.	20.0	30.0	65.0
Western Farmers Assoc.:			
Seattle, Wash.	<u>16.0</u>	<u>18.0</u>	<u>27.0</u>
Total	78.0	78.0	167.0

¹ Does not include plants which mixed urea and ammonium nitrate solutions.

Appendix table 5—Design annual capacity of dry bulk-blending plants of regional cooperatives on January 1, 1960, 1965, 1970, and 1972¹

(Based on tons of material or product)

Cooperative and headquarters	Annual capacity			Number of plants
	1960	1965	1970	
	<u>1,000 tons</u>			1970
Agway Inc.: Syracuse, N.Y.	0	12	69	29
Indiana Farm Bureau Coop. Assoc.: Indianapolis, Ind.	6	6	6	3
Farmland Industries: Kansas City, Mo.	0	275	245	18
Farm Bureau Services, Inc.: Lansing, Mich.	0	10	57	6
Centrala Farmers Cooperative: Selma, Ala.	12	16	16	1
Valley Nitrogen Producers, Inc.: Helm, Calif.	0	0	40	1
Landmark, Inc.: Columbus, Ohio	0	10	10	8
Grower Fertilizer Coop.: Lake Alfred, Fla.	50	50	50	1
Waverly Growers: Waverly, Fla.	20	20	20	1
Midland Cooperatives, Inc.: Minneapolis, Minn.	50	50	50	19
Farmers Union Central Exchange: St. Paul, Minn.	40	80	80	19
Missouri Farmers Association: Columbia, Mo.	22	125	225	87
Ohio Farmers Grain & Supply Assoc.: Fostoria, Ohio	0	5	5	1
Intermountain Farmers Association: Salt Lake City, Utah	2	4	8	5
Western Farmers Association: Seattle, Wash.	<u>4</u>	<u>40</u>	<u>60</u>	<u>15</u>
Total	206	703	941	214

¹ Does not include bulk blend plants of affiliated cooperatives.

Appendix table 6—U.S. fertilizer consumption, 1959/60, 1964/65, and 1969/70

Product	1959/60	1964/65	1969/70
	1,000 tons		
Nitrogen materials:			
Anhydrous ammonia	708.9	1,545.3	3,468.4
Aqua ammonia	427.0	719.6	701.4
Ammonium nitrate	1,231.3	1,628.6	2,844.4
Other	131.8	81.9	153.4
Ammonium sulfate	534.8	774.5	781.9
Nitrogen solutions	650.3	1,883.9	3,242.9
Sodium nitrate	454.3	301.1	85.5
Urea	142.2	427.6	533.5
Ammonium nitrate limestone	264.0	170.4	86.8
Total	4,544.6	7,532.9	11,898.2
Phosphate materials:			
Phosphate rock	661.6	414.0	170.1
Superphosphates:			
22 percent and under	506.8	468.0	312.0
Over 22 percent	403.0	665.1	1,204.6
Ammonium phosphates ¹	570.7	719.5	644.1
Diammonium phosphates ²	105.2	651.5	1,576.7
Other	66.3	168.8	191.1
Total	2,413.6	3,086.9	4,098.6
Potash materials:			
Potassium chlorides	389.4	739.3	2,172.6
Other	84.9	121.8	237.3
Total	474.3	861.1	2,409.9
Secondary & micronutrient materials:			
Gypsum (calcium sulfate)	1,297.0	1,410.9	1,151.6
Other	81.1	110.4	144.9
Total	1,378.1	1,521.3	1,296.5
Natural organic materials:			
Dried manure	312.2	360.4	350.6
Other	79.3	228.8	150.8
Total	491.5	589.2	501.4
Total materials ³	9,302.1	13,591.4	20,204.6
Mixtures: ^{2 4}			
N-P-K	13,985.0	15,389.5	17,018.6
N-P ²	429.7	852.2	812.7
N-K	857.1	324.4	346.4
P-K	303.5	1,168.6	1,208.3
Total	15,575.3	17,734.7	19,386.0
Total fertilizers	24,877.4	31,326.1	39,590.6

¹ Includes only grades 11-48-0, 13-39-0, 16-20-0, 21-53-0, and 27-14-0.² Diammonium phosphate (grades 18-46-0 and 16-48-0) were shifted from N-P mixtures to a separate ammonium phosphate item.

Continued

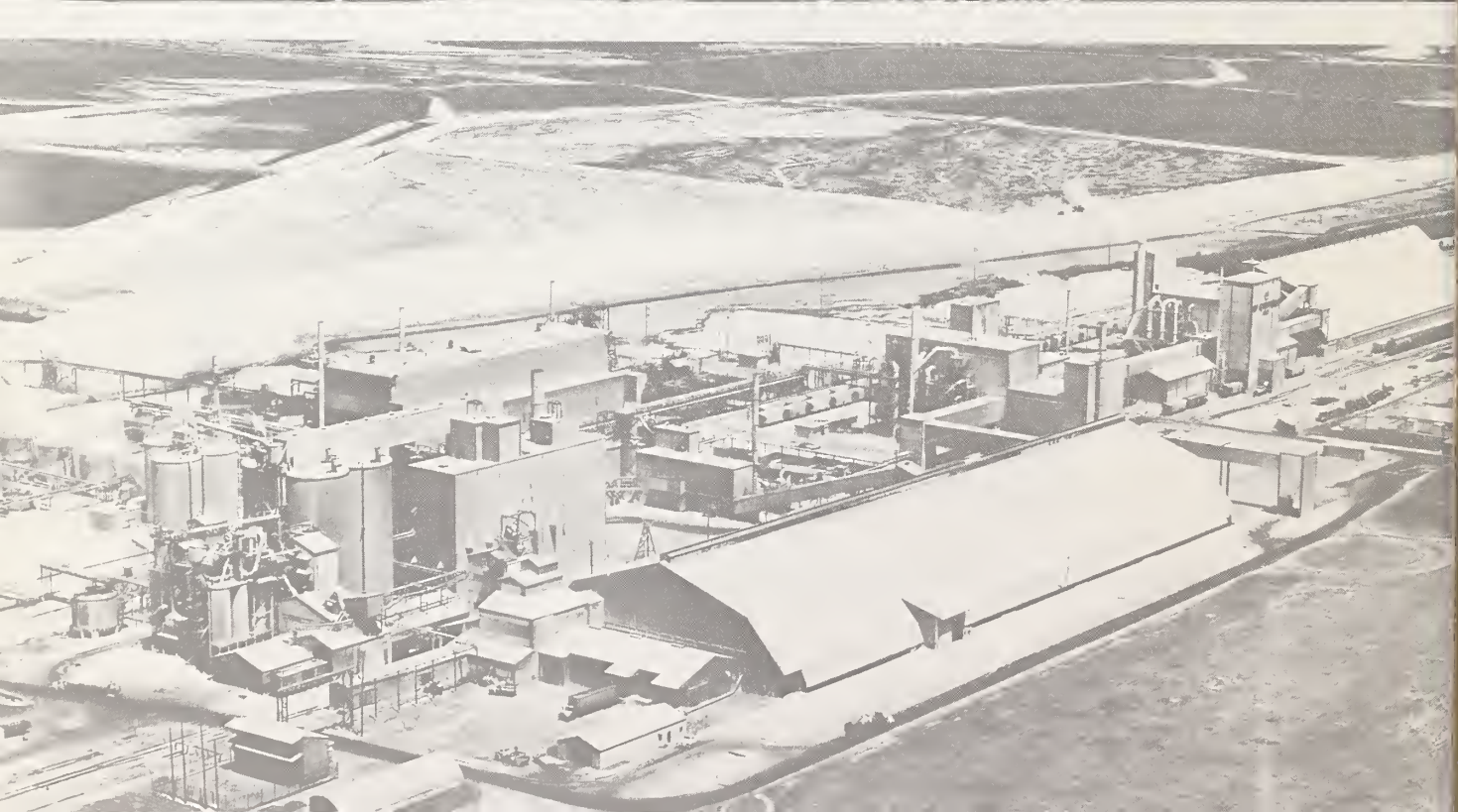
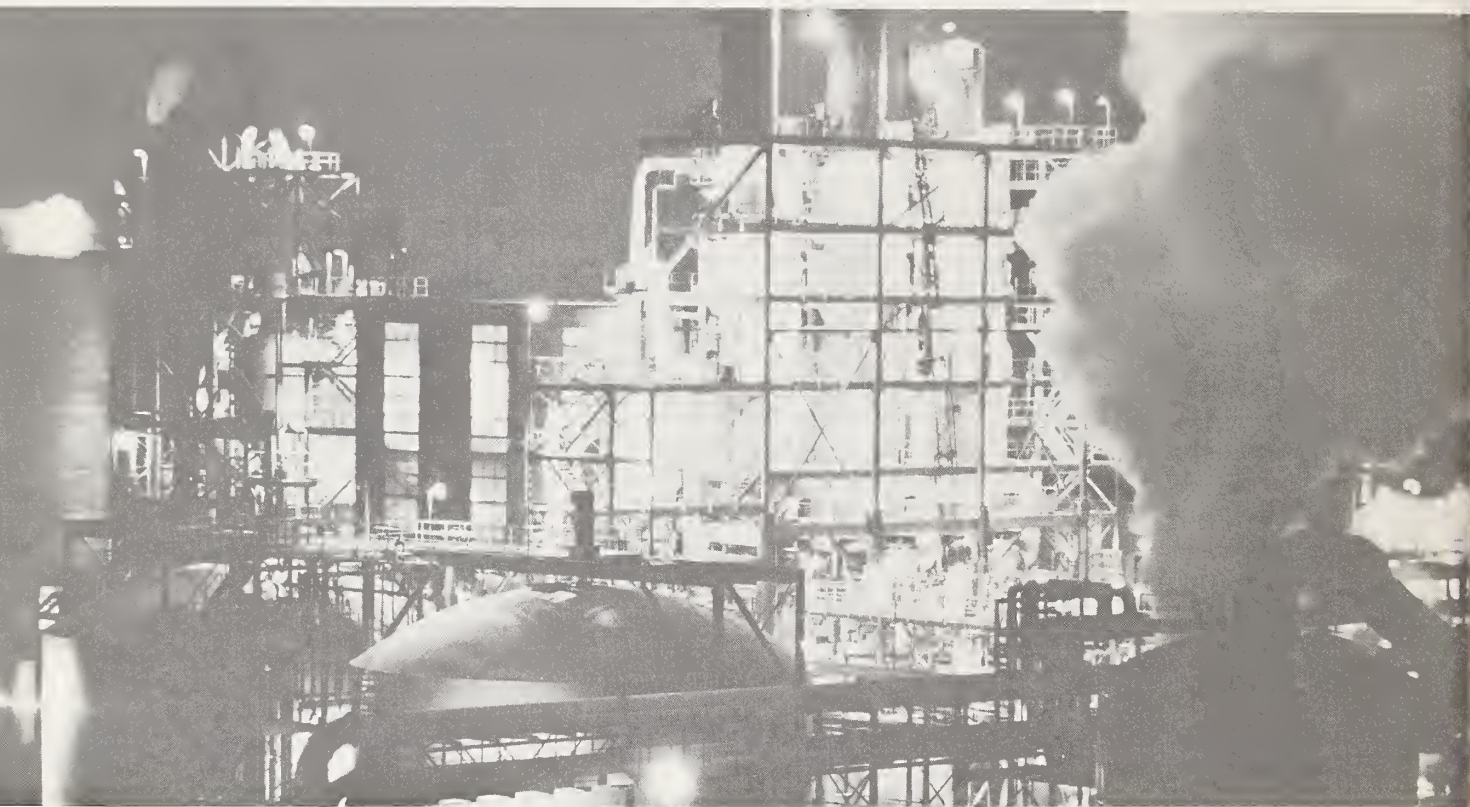
³ Total materials were sold in following forms:

	<u>1959/60</u>	<u>1964/65</u> <u>1,000 tons</u>	<u>1969/70</u>
Dry	7,441.7	9,054.6	11,516.6
Liquid	1,860.4	4,536.8	8,688.0
		<u>1966/67</u>	<u>1969/70</u>
		<u>Percent of total dry</u>	
Dry—bagged	--	40.4	30.1
Dry—bulk	--	59.6	69.9

⁴ Total mixtures were sold in following forms:

	<u>1959/60</u>	<u>1964/65</u> <u>1,000 tons</u>	<u>1969/70</u>
Dry	14,999.0	16,741.6	17,059.7
Liquid	576.3	993.1	2,326.3
		<u>1966/67</u>	<u>1969/70</u>
		<u>Percent of total dry</u>	
Dry—bagged	--	62.9	54.6
Dry—bulk	--	37.1	45.4

Two of the world's largest phosphate chemical complexes are within a few miles of each other and near Bartow, Fla. The top one is owned by Farmland Industries, Inc., Kansas City, Mo. The bottom one is owned by CF Industries, Inc., Chicago, in turn owned by Farmland and 17 other regional cooperatives in the U.S. Farmland built its plant, opening it in 1966. CF Industries purchased its plant in 1971. Both plants produce around one million tons of phosphorus-type fertilizer materials annually.



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Statistics of Farmer Cooperatives, 1969-70. FCS Research Report 22, Jane Click.

Supply Cooperatives, Bulletin Reprint 2.

Integrated Petroleum Operations of Farmer Cooperatives, 1969. FCS Research Report 21, J. Warren Mather and John M. Bailey.

Handbook on 20 Major Regional Cooperatives Handling Supplies, 1968, 1969, and 1970. FCS Research Report 20, J. Warren Mather.

Financial Structure of Regional Farmer Cooperatives. General Report 133, Nelda Griffin.

Approaches and Problems in Merging Cooperatives. Information 54, Martin A. Abrahamsen and J. Warren Mather.

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